PB90-256686

Some Major Factors Important in Establishing Land Use Policy for Remediated Superfund Sites

Georgia Univ., Athens

Prepared for:

Environmental Protection Agency, Washington, DC

Dec 89

U.S. Department of Commerce
National Technical Information Service
NTIS

50272 - 101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/101/F-90/027	2.	3. PB90-256686

4. Title and Subtitle
Some Major Factors Important in Establishing Land Use Policy For Remediated Superfund Sites

5. Report Date
Completed Fall 1989

6.

7. Author(s)
Susan R. Crow

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
ICAD - Old College
Univeristy of Georgia
Athens, GA 30605

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
Office of Cooperative Environmental Management
499 South Capital Street, SW A-101-F6
Washington, DC 20460

13. Type of Report & Period Covered
Technical Report

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

3101 - Some Major Factors Important in Establishing Land Use: Policy For Remediated Superfund Sites.

The report is part of the National Network for Environmental Management Studies under the auspices of the Office of Cooperative Environmental Management of the U.S. Environmental Protection Agency.

No explicit federal policy addresses future land use of remediated Superfund sites. The EPA has no official land use policy for these sites and most states have no mechanisms for identifying uncontrolled hazardous waste sites, and mo policies or procedures for guiding redevelopment of remediated sites.

Historically, land use decisions have been made by local governments. However, local governments are subject to political pressures which impact land use decisions, and may override environmental and health concerns. Thus, federal and state participation is vital in devising land use controls.

In the Absence of formal policy, a variety of factors impact land use decisions. four general concerns are scientific uncertainty and technological limitations, cleanup standards and risk assessment, institutional controls, and liability for remediation costs.

The report concludes that the principal goal of land use policy should be to allow the most effective allocation and utilization of available resources to meet the legislative purpose of health and environmental protection. Various possible land use policy objectives are proposed.

17. Document Analysis a. Document Descriptors

b. Identifier's/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18)

OPTIMAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

PB90-256686

SOME MAJOR FACTORS IMPORTANT IN ESTABLISHING LAND USE POLICY FOR REMEDIATED SUPERFUND SITES

Report Submitted to U.S. Environmental Protection Agency, Region IV
Waste Management Division

Report Submitted by Ms. Susan R. Crow, EPA Fellow, School of Environmental Design,University of Georgia, Athens, GA
Dr. James L. Cooley, Faculty Sponsor, Institute of Community and Area Development, University of Georgia, Athens, GA

December 1989

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

Disclaimer

This report was furnished to the U. S. Environmental Protection Agency by the graduate student identified on the cover page, under a National Network of Environmental Policy Studies fellowship.

The contents are essentially as received from the author. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention, if any, of company, process, or product names is not to be considered as an endorsement by the U. S. Environmental Protection Agency.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS....iii

EXECUTIVE SUMMARY....iv

THE PROBLEM....1

STATUS OF POLICY FOR REDEVELOPMENT OF REMEDIATED HAZARDOUS WASTE SITES....3

- Federal Government....3
- U.S. Environmental Protection Agency....3
- State Governments....3
- Local Governments....4

IMPACTS OF PRESENT POLICIES AND PRACTICES ON LAND USE OF REMEDIATED SITES....5

- Scientific Uncertainty and Technological Limitations....5
- Cleanup Standards and Risk Assessment....6
- Institutional Controls....7
- Liability....8

MAJOR FACTORS IMPORTANT IN THE DEVELOPMENT OF LAND USE PLANS FOR UNCONTROLLED HAZARDOUS WASTE SITES....10

- Factors Influencing Land Use Decisions at Some Superfund Sites....10
  - Times Beach, Missouri....10
  - Love Canal, New York....11
  - Bunker Hill, Idaho....14
  - Luminous Processes, Georgia....15
- Factors Considered in the Private Development of Remediated Uncontrolled Hazardous Waste Sites in the United States....15
- Factors Considered in Land Use Decisions for Contaminated Sites in the United Kingdom....17

FACTORS IMPORTANT IN THE DEVELOPMENT OF LAND USE POLICY FOR REMEDIATED SUPERFUND SITES....19

APPENDIX A. LIST OF CASE STUDIES BY KINGSBURY AND RAY (1986)....23

APPENDIX B. SURVEY OF SITES DELETED FROM THE NATIONAL PRIORITIES LIST....24

LIST OF CONTACTS....42

BIBLIOGRAPHY....45

ACKNOWLEDGEMENTS

I wish to thank Dr. Elmer Akin and Ms. Erika Thorgerson, U.S. Environmental Protection Agency, Region IV, for their assistance with this project. I also extend my appreciation to all EPA personnel and other contacts whose informative and thoughtful responses made the content of this report much richer. I am especially grateful to Ms. Garrie Kingsbury, Research Triangle Institute, who was most encouraging, and generous in sharing her project files and her time. I thank Mr. John (Alec) Little, Institute of Community and Area Development, University of Georgia, for his advice early in the project and his valuable comments on a draft report. Finally, I thank Dr. James Cooley for his encouragement and patience throughout the project and his valuable assistance in completing the final report.

EXECUTIVE SUMMARY

No explicit federal policy addresses future land use of remediated Superfund sites. The EPA has no official land use policy for these sites. Discussion of future use varies considerably among Records of Decision. Most states have no mechanisms for identifying uncontrolled hazardous waste sites, and no policies or procedures for guiding redevelopment of remediated sites.

Historically, land use decisions have been made by local governments. However, local governments are subject to political pressures which impact land use decisions, and may override environmental and health concerns. Thus, protection of community health and environment may require state and federal participation in devising land use controls and redevelopment guidelines for remediated Superfund sites.

In the absence of formal policy, a variety of factors impact land use decisions. Four general concerns are scientific uncertainty and technological limitations, cleanup standards and risk assessment, institutional controls, and liability for remediation costs. In addition, case studies of Superfund sites, and other uncontrolled hazardous wastes sites in the U. S. and United Kingdom revealed factors influencing land use decisions at specific sites. Literature review indicated that the following considerations influence site remediation and redevelopment:

- limitations of current knowledge
- resource limitations
- specific site characteristics
- legal issues
- community social, political, and economic concerns
- ethical issues

The report concludes that the principal goal of land use policy should be to allow the most effective allocation and utilization of available resources to meet the legislative purpose of health and environmental protection. Various possible land use policy objectives are proposed.

THE PROBLEM

Nationwide, uncontrolled disposal of hazardous wastes has resulted in release of toxic substances into water, land, and air. Reports of groundwater and surface water contamination, lost drinking water supplies, and evacuation and permanent relocation of entire communities have dramatically increased public awareness of problems associated with hazardous wastes. Across the nation people are concerned about threats to their health, loss of natural resources, and severe devaluation of their homes and property. Congress responded to public concerns with the enactment of the Resource Conservation and Recovery Act (RCRA) of 1976, which addressed the effective management of newly generated hazardous wastes.

Following RCRA, the need for a federal program to cleanup existing uncontrolled hazardous waste sites became apparent, and Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. CERCLA established Superfund to respond to emergency releases of hazardous substances into the environment, to clean up uncontrolled sites, and to identify and seek cost recovery from those responsible. In 1986, CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA), which extended and expanded existing legislation. Significant aspects of SARA include a statement of preference for permanent solutions and treatment technologies in site cleanups, establishment of national cleanup standards, and,provision for citizen suits in the event a CERCLA requirement is violated.

The federal agency responsible for implementing CERCLA/SARA is the U. S. Environmental Protection Agency (EPA). Regulations implementing CERCLA/SARA are promulgated by EPA in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Included in the NCP is a list of sites requiring action under Superfund, the National Priorities List (NPL). Currently, approximately 1,200 sites are listed on the NPL. A report by the Office of Technology Assessment (OTA) estimated that eventually 10,000 sites across the nation may require cleanup by Superfund (U.S. Congress, OTA, 1985). The estimated cleanup cost to Superfund for these sites is $100 billion, and the expected cleanup time is 50 years.

From the inception of the Superfund program, Congress intended the program to be a joint federal and state effort. Federally initiated remediation efforts require states to provide 10 percent of the funds required for cleanups or 50 percent if the property is state owned. Also, it was expected that states would undertake some cleanups independently. To date, most states do not have policies or procedures for identification, cleanup, or redevelopment of hazardous waste sites (Kingsbury and Ray, 1986). Some states, those with a large number of uncontrolled hazardous waste sites, have developed extensive programs for site identification and remediation. However, many states have been reluctant to provide matching funds required for federal lead cleanup actions (U.S. Congress, OTA, 1985). Several reasons have been advanced to explain the lack of greater state initiative in cleanup efforts; for these reasons it is suggested that states roles in the Superfund program cannot be expanded (see *State Governments*).

The magnitude of the Superfund remediation task is enormous and made considerably more difficult by the lingering and debated question "how clean is clean?" Section 9621(d) of SARA discusses degree of cleanup at Superfund sites. However, "Neither the statute nor regulations set forth a 'durable' cleanup standard -- that is, a meaningful quantitative standard not subject to extensive qualification or broad exceptions"

(Sheridan, 1986-87). The cleanup standards specified in CERCLA/SARA are derived from standards and criteria specified in other environmental legislation. As the cleanup standards have not been established specifically for application to Superfund site remediation, they may or may not be appropriately applied at a given site. The selection of "applicable" or "relevant and appropriate" standards remains at the discretion of EPA. Some have concluded that the EPA's policies, which emphasize a case by case review process, preclude achieving consistent levels of cleanup (Sheridan, 1986-87; U.S. Congress, OTA, 1988).

Another problem with the selection of appropriate cleanup standards is that standards protective of human health and the environment do not exist for many toxic substances found at Superfund sites. Furthermore, little information is available regarding synergistic effects of the multiple chemicals found at most Superfund sites. The absence of this information means that synergistic effects are not considered in assessing the hazards posed by these sites. In addition, little is known regarding standards necessary to protect the natural environment. Extremely limited knowledge in this area has led to remedial designs based exclusively on protection of human health. EPA is presently attempting to develop guidelines for environmental protection standards.

The issue of site cleanup is complicated further by technical and resource limitations. At present, the technology does not exist to clean up contamination at some sites. SARA's preference for treatment technologies (as opposed to the more common approach taken under CERCLA, removal of contamination for disposal off-site) will result in some degree of contamination remaining at most sites. Most currently available treatment technologies are not capable of removing 100 percent of contamination from soil or water. And, in some cases, the degree of contamination remaining on-site will not allow unrestricted use of the land in the future. This fact is evidenced in the recent increase in institutional controls, such as prohibitions on groundwater use or deed restrictions (as recorded in the Records of Decision [ROD], the administrative record of remedial actions at Superfund sites), to supplement engineering solutions to site cleanup.

The cost of remediation efforts at Superfund sites can be considerable, far exceeding the market value of the property after cleanup. The CERCLA/SARA legislation requires fund balancing; that is, appropriate remedial action should provide a cost-effective response, allowing a balance between the need for protection of public health and the environment and the availability of amounts from Superfund. Given the large number of uncontrolled hazardous waste sites across the country, difficult choices must be made, choices that will limit cleanup efforts at some sites to allow remedial actions at other sites.

As described above, many difficulties are associated with the cleanup of hazardous waste sites across the nation. As remediation efforts continue and more sites are "cleaned up," pressures for redevelopment of these sites, especially those in areas experiencing rapid growth, will increase. The issue of future land use of remediated Superfund sites is one that will receive increasing attention in the future as emphasis on citizen participation invites the involvement of interested parties, including local citizen groups, environmental groups, and developers, in the remediation process.

STATUS OF POLICY FOR REDEVELOPMENT OF REMEDIATED HAZARDOUS WASTE SITES

Federal Government. No explicit federal policy addresses the question of future land use; however, current policies and procedures do have an impact on future use of remediated sites (refer to the following section of this report). In addition, resolution of debate over specific site remediations and SARA's provision allowing citizen suits may help to define public policy regarding future land use at remediated Superfund sites.

Decisions regarding cleanup levels are policy decisions that profoundly impact future land use at remediated sites. With the introduction of SARA in 1986, national standards were established to guide cleanup at Superfund sites. However, the standards are discretionary and the selection of cleanup goals and objectives for Superfund sites remains largely an ad hoc process. In this context, the issue of future land use has been debated in the draft consent decree between the U. S. and Shell Oil Company for the Rocky Mountain Arsenal site in Colorado. (A federal facilities agreement has since been developed for this site.) A group of environmentalists (interested in complete restoration of the site) and developers (interested in site redevelopment) have argued that CERCLA/SARA mandates remediation of Superfund sites to the most beneficial land use. In response the U. S. acknowledged such a mandate and stated an intention to fulfill the mandate through the consent decree. The U. S. government's position in this case suggests a federal policy for Superfund sites remediation that allows the most beneficial use of the land in the future. Such a policy would have considerable impact on the remedy selection process, cleanup efforts, and the cost of remediation at Superfund sites.

It is also possible that the provision for citizen suits under SARA, through the judiciary system, may define national policy regarding acceptable risk and reasonable expectations for the remediation and reuse of uncontrolled hazardous wastes sites. Opportunity for public discussion and debate of issues may assist in developing a national consensus regarding reclamation and redevelopment of Superfund sites.

U. S. Environmental Protection Agency. The EPA has no official policy regarding land use of remediated Superfund sites. A number of the EPA employees interviewed during this study (see List of Contacts) indicated that the mission of the agency is protection of human health and the environment, and this mission does not include a land use planning function. In all its environmental programs, EPA has consistently avoided being involved in land use planning, direct or implied.

The discussion of future land use varies considerably among RODs. For example, the ROD for Times Beach, Missouri, discusses issues related to future land use at length and specifies that future land use at Times Beach will be nonresidential uses. The Times Beach ROD is probably atypical in this respect, because review of other RODs indicates little or no mention of future land use. Furthermore, some RODs do not include discussions or recommendations for institutional controls even though residual contamination will remain on-site (examples include the Schmalz site, Wisconsin; Lehigh Electric site, Pennsylvania; and, Combe Fill North Landfill, New Jersey). In other cases RODs may recommend institutional controls that are never implemented (Friedman Property, New Jersey).

State Governments. Most states have no mechanisms for identifying uncontrolled hazardous waste sites and no policies or procedures for guiding redevelopment of remediated sites (Kingsbury and Ray, 1986). Some states, usually those with many

uncontrolled hazardous waste sites, do have extensive programs. Such states include New York, New Jersey, California, and Illinois (U.S. Congress, OTA, 1985). Various reasons have been proposed to explain why some states have not made greater efforts to meet their current and future needs for hazardous wastes sites remediation. Suggested explanations include the following: state priorities do not give high rank to this environmental problem; local obstacles exist that prohibit raising revenues for this purpose; the federal program is perceived as uncertain and ineffective; and states lack technical expertise, budgets, and personnel to assume major responsibilities for leading remediation efforts or to accomplish other aspects of the Superfund program, such as site identification, selection, and long-term monitoring. These considerations, and others, led the OTA to conclude that there is little reason to believe that most states could play a stronger role in the Superfund program (U.S. Congress, OTA, 1985).

Local Governments. Historically, land use decisions have been made at the local level of government. Although it seems necessary and desirable that land use decisions continue to be local decisions, pressures on local governments suggest the need for outside involvement in the decision-making process for remediated Superfund sites. For example, local governments in general tend to be more responsive to development interests than to environmental issues. This is one of the factors that has led to the implementation of environmental legislation at the federal level during the past two decades (Barrows, 1982). Local governments also are reluctant to institute or enforce land use controls that are perceived to threaten the economic stability of the community (i.e., jobs) or present or future tax revenues (Nicholas, 1988). Thus, local governments are subject to considerable political pressures that impact land use decisions and may override environmental and health concerns. Review of the public comments in various RODs, including Times Beach, Missouri, and Bunker Hill, Idaho (presented later in this report), indicate community concerns that elevate economic considerations above health and environmental considerations at these sites. Pressures on local government may be severe in some cases. Thus, protection of community health and environment may require state and federal participation in the development of land use controls and redevelopment guidelines for remediated Superfund sites.

A principal function of local government is regulation of future land use of remediated sites through the design, implementation, and enforcement of institutional controls. However, the issues raised by the future use of remediated sites where contamination remains on-site are new and beyond the capacity of most local governments to address without technical support and guidance. The design of appropriate institutional controls often will require technical assistance from the regional office of EPA and the state government. Obtaining needed assistance may be difficult, since considerable confusion exists among EPA regions regarding when and how to use institutional controls appropriately (Nicholas, 1988).

Not surprisingly, confusion exists at the local level regarding the regulation of future land use of remediated sites. For example, a local planner contacted in the course of this study stated that the county planning department did not feel that the local government had the authority to regulate development of a site in their area that had been deleted from the National Priorities List. He stated that the major concern was that attempted regulation would be viewed as a "taking." A taking occurs when the exercise of governmental power of eminent domain removes a property right(s) without payment of just compensation to the landowner). Attitudes like this may be understood in situations where no state policies or procedures exist, and no discussion or recommendation for institutional controls on future land use are contained in the ROD for the site.

IMPACTS OF PRESENT POLICIES AND PRACTICES ON LAND USE OF REMEDIATED SITES

In the absence of a formal policy regarding the future land use of remediated Superfund sites, a variety of factors impact land use decisions. This section explores four important concerns: scientific uncertainty and technological limitations, cleanup standards and risk assessment, institutional controls, and liability for remediation costs.

Scientific Uncertainty and Technological Limitations. The release of chemicals into the environment may result in several types of hazards, including ignition or explosion--some chemicals are prone to ignite or explode, causing physical damage and potential spread of the chemicals over large areas; corrosion--corrosive chemicals may directly damage health or the environment by causing a breach of natural or engineered barriers; and toxicological hazards. A particular chemical may present several types of toxicological hazards. The chemical may be acutely toxic, or it may produce chronic adverse effects over longer exposure periods. In addition, special populations, such as children, the elderly, or pregnant women, may be more affected by lower levels of exposure than the general population.

Although the inherent toxicity of several chemical has been studied in depth, a National Academy of Sciences report recently concluded that most chemicals have not been examined adequately to ascertain all their potential toxic effects. Based on a study of randomly selected compounds, the report estimated that no toxicity information is available on 76 to 82 percent of chemicals in commerce included on the Toxic Substances Control Act Inventory, 38 percent of pesticides and inert ingredients of pesticides formulations, 56 percent of cosmetic ingredients, 25 percent of drugs and excipients used in drug formulations, and 46 percent of food additives. Less than 18 percent of chemicals in the categories outlined above were estimated to have sufficient toxicological data bases to provide complete health hazard assessments.

Furthermore, most Superfund sites are contaminated by a combination of chemicals. Thus, it is important to consider chemical and toxicological interactions. Chemical interactions may result in new compounds whose physical, chemical, and toxicological properties are significantly different from the original chemicals. Few chemical mixtures have been examined to date, and little is known about the potential of toxicological interactions. Lack of knowledge in this area has resulted in possible synergistic interactions being ignored, thus adding another dimension of uncertainty to site assessment.

In addition to the limited toxicological data for specific chemicals, limited information exists on the health effects associated with actual uncontrolled hazardous wastes sites. Significant scientific uncertainty is associated with the few studies that have examined health effects associated with such sites. Furthermore, little information exists regarding the impact of chemical on the natural environment. The absence of such information has resulted in remediation efforts designed exclusively to protect human health, without regard to environmental protection.

Limitations of technology affect various aspects of remediation goals and procedures. Sampling technology limits the extent to which chemical identities and levels can be established at a site. In some cases, analytical procedures may limit knowledge of chemicals present at a site, as well as the certainty that desired remediation levels have been achieved. Cleanup technologies are similarly limited. Many prospective cleanup technologies are in research or pilot stages of development. Most technologies will

leave some level of residual contamination after implementation; some will produce new wastes. All of these factors impact degree of cleanup and the ultimate reuse of the land.

Cleanup Standards and Risk Assessment. The choice of a remediation goal or standard is ultimately a policy decision that critically impacts potential site redevelopment. Neither the CERCLA/SARA legislation nor current regulations establish quantitative cleanup standards that are not subject to extensive qualification or broad exceptions. It seems likely that in the absence of concise and well-supported remediation goals, the selection of cleanup technologies and the evaluation of cleanup performance will remain questionable. In a report to Congress, the OTA concluded, "It appears necessary to elevate policymaking on the degree of cleanup to the statutory level and clarify the role of the Federal Government in determining levels of cleanup performed by States and responsible parties" (U. S. Congress, OTA, 1985). This conclusion is further supported by the present remedy selection process, which may result in lower cleanup levels than those originally proposed as various criteria are balanced to establish the final remediation plan.

Standards for cleanup levels have been borrowed from other environmental legislation. Established standards may be based on data obtained from a variety of sources, such as occupational studies. Such standards may or may not be appropriate for establishing cleanup at Superfund sites. For example, occupational standards are based on studies of average adults in work settings that limit exposure to 40 hours per week. Information obtained from such studies may not be applicable at Superfund sites. Selection of "applicable" or "relevant and appropriate" standards remains at the discretion of EPA. It has been argued that the present EPA practice emphasizing case by case review precludes achieving consistent levels of cleanup at Superfund sites (Sheridan, 1986-87; U.S. Congress, OTA, 1988).

The risk assessment process developed by EPA attempts to establish a uniform procedure for assessing the wide range of conditions existing at Superfund sites. The goal of risk assessment is to ensure that selected remedies protect human health and the environment. The components of a risk assessment include 1) the identification of contaminants of concern; 2) assessment of toxicity; 3) assessment of exposure; and 4) characterization of risk. There are various uncertainties associated with assessing conditions at a Superfund site. Some of these have been discussed in the previous section. In addition to the uncertainties associated with site conditions, the process of risk assessment also has inherent uncertainties.

An important risk assessment issue is determining what constitutes a reasonable maximum exposure scenario for future land use. The most restrictive option is to assume that future use will be residential and that dermal and ingestion exposures to children is likely. According to an interview with an environmental scientist at EPA Headquarters, almost all risk assessments assume residential use as the future use scenario. While such an assumption appears to represent a conservative approach to establishing risk, it may not accurately reflect future land use. At some sites, residential development is unreasonable; for example, in industrial areas where redevelopment for homes is not feasible. In such instances, the future residential use scenario may lead to a more extensive (and expensive) cleanup than would be warranted by an industrial reuse scenario. Developing realistic future land use scenarios for risk assessment invites consultation with state or local planning agencies; however, none of the personnel interviewed during this study indicated that planning agencies are consulted during the remediation process.

Determining future land use scenarios for risk assessment also illustrates another important issue, the tendency to incorporate elements of risk management in the risk assessment process. Risk assessment is the calculation of the probability of adverse outcomes such as injury or death. Risk management incorporates other factors such as acceptability of risk, costs and benefits, and policy into the process of selecting a particular course of action in a given circumstance. Automatic selection of residential use as the future use scenario, even though such use is unlikely or impossible, represents a policy decision that clearly affects the outcome of the risk assessment. Incorporating elements of risk management in the risk assessment process creates confusion about the "scientific" or "objective" content of policies and decisions.

As mentioned before, risk assessments for Superfund sites also are limited because they do not consider the effect of chemical mixtures. The toxicological data upon which risk assessments are based assume exposure to a single chemical. The methodology assumes the risk associated with each exposure medium (groundwater, surface water, soil, air) to be cumulative of the risks associated with each substance in that medium and does not consider possible synergism or antagonism among substances in a single exposure medium. Nor does the methodology consider that individual substances may have multiple health effects.

Finally, the issue of risks resulting from off-site factors may be very important. For example, urban populations, especially those located near heavily industrial areas, already may be exposed to high cancer risks from pathways unrelated to the Superfund site itself. These additional risks may or may not be considered in developing the final remedy for the site.

Institutional Controls. The capacity of government and appropriate agencies to ensure that future land use is compatible with the cleanliness levels achieved in the remedy is the issue here. Institutional controls are defined by the EPA as "non-engineering mechanisms used to prevent or limit access to contaminated areas and therefore reduce or eliminate risk" (Nicholas, 1988). Thus, the intended application of institutional controls is supplemental to engineering-based technologies for short- and long-term management to prevent, or limit, exposure to hazardous substances, pollutants, or contaminants. Examples of commonly employed institutional controls include development of alternate water supplies and legal mechanisms such as land-use restrictions, well drilling restrictions, zoning ordinances, deed notices, and advisories.

Presently, EPA has no formal policy governing design, implementation, and enforcement of institutional controls. However, various groups, including regional EPA offices and state and local governments, have sought guidance from EPA policy-makers. According to a recent report, EPA is in the process of drafting guidelines for the use of institutional controls (Nicholas, 1988).

The review by Nicholas (1988) indicates that inclusion of institutional controls in RODs is increasing. The review also illustrates a number of administrative problems associated with institutional controls as they are developed presently. First, the process by which institutional controls are incorporated into site remedies is largely ad hoc. The process varies from region to region, site to site, and in accordance with the preference and power of the players involved in developing the remedy (i.e., federal, state, and local governments, citizen action groups, and responsible parties). Regional EPA offices often are confused about when and how to use institutional controls; thus, the frequency and range of controls varies widely across regions. The ad hoc approach to the implementation of institutional controls impacts the substance of the controls. This

approach, and the lack of guidelines for the use of institutional controls, results in recurrence of bad controls and duplicative efforts among regions attempting to devise similar controls.

Other procedural issues include clear delineation of responsibility for implementation and enforcement of institutional controls. If controls are recommended but not implemented, or if they are implemented but not enforced, the controls will not serve the intended function of protection of human health and environment. Nicholas (1988) presents a number of case studies that demonstrate the failure of institutional controls with regard to design, implementation, and enforcement and provides various recommendations to improve their effectiveness.

In spite of the increased appearance of institutional controls in RODs, the use of these controls remains highly controversial. At the heart of much of the controversy is the concern that because institutional controls are easier and less expensive measures than engineering-based technological solutions, their use will sabotage opportunities for permanent remedies. Thus, use of institutional controls could fail to meet goals of protection of human health and the environment and also limit future uses of the land.

Various groups are challenging the legality of institutional controls on the basis that the Congressional aim in enacting SARA was to mandate permanent cleanup at all sites where CERCLA authority is exercised. They argue that permanent remedies preclude long-term land use restrictions. Furthermore, some interested parties argue that CERCLA mandates that remediation efforts must restore a site to its most beneficial use. Long-term land use restrictions are clearly counter to such a mandate. Proponents on both sides of these arguments have valid positions, and the debate is likely to be protracted and difficult. The resolution of these controversies will have important implications for future land use of remediated sites.

Regardless of the controversy surrounding institutional controls, by incorporating long-term institutional controls, including land-use restrictions, into RODs, EPA implicitly acknowledges that some remediation efforts are less than perfect restorations. The degree of remediation has important implications, perhaps best summarized in the following finding by a recent OTA study:

> Most RODs seem uncertain about or do not address future land and water use in judging whether a selected remedy will be safe and permanent. In some cases, there is a lot of interest in reusing the land for productive purposes. For example, at the Schmalz site in Wisconsin, where contaminated soil is to remain in place, the ROD makes no land use restrictions. Any remedy that leaves hazardous waste in place or caps it suggests the need for explicit attention to future land and perhaps groundwater use (U.S. Congress, OTA, 1988).

Liability. In enacting the CERCLA/SARA legislation, Congressional intent was clearly to recover cleanup costs from those parties responsible for the existence of hazardous wastes at the site. Although this is seemingly a logical and just approach to financing remediation efforts, some have argued that the approach should be modified or abandoned in favor of other alternatives (Lyons, 1986-87; Roberts, 1987; Sheridan, 1986-87). The primary reasons for opposition to the current approach include the following: 1) the prolonged negotiation and litigation associated with cost recovery from responsible parties extend cleanup efforts for years; 2) the process promotes compromise of cleanup efforts in order to achieve an agreement with responsible parties and thus fails the fundamental goal of the legislation (i.e., to protect health and the

environment); and 3) the prolonged litigation to recover cleanup costs and determine ownership wastes funds that could be used better to remediate the property and also undermines efforts to make beneficial use of the site following remediation.

The courts have established the liability standard under CERCLA to be that of "strict liability," meaning that all persons (including current site owners, current operators, property owners at the time of waste disposal, generators of the disposed wastes, and transporters of the hazardous wastes) are potentially responsible for cleanup costs regardless of fault or negligence. In addition, the courts have judged the liability to be "joint and several." That is, each person is liable for the full amount of the cleanup costs. An important implication of this liability standard is that developers purchasing contaminated properties may be liable for all cleanup costs. The remediation costs may far exceed the market value of the property.

The liability issue associated with contaminated land has had a marked impact on the real estate market. Environmental audits have increased substantially in an attempt by businesses to avoid acquiring contaminated properties. Corporations are engaging in "land banking" practices in cases where they suspect or know that land is contaminated. They are simply holding the land and not attempting to sell or use it. In other cases owners wanting to sell the property, and developers wanting to use the land, are "cleaning up" the contamination without reporting it to appropriate agencies. Such "cleanups" may not result in the best remediation of the site, and may make it more difficult to discover the existence of contamination on the property. A representative of the California Department of Health indicated that the department was aware of the problem of unreported "cleanups," and hoped that by publishing cleanup standards and guidelines they might at least promote better efforts.

The liability concern also has affected the practices of lending institutions. Banks do not want to finance purchase of property that might be contaminated, because they may become responsible for financing site cleanups, either after purchase or later in the event of foreclosure. Potential liability at foreclosure also has resulted in more conservative lending practices for businesses engaged in activities that could lead to contamination of the property.

In addition to federal legislation, individual states are enacting legislation that has important implications for the future land use of remediated hazardous waste sites. For example, the 1983 New Jersey Environmental Cleanup Responsibility Act (ECRA) requires that specified industries that use hazardous substances or wastes complete adequate cleanup of any contamination on their properties before closure, sale, or transfer of their operations. (Presently, the only other state with similar legislation is Connecticut.) The state environmental agency must approve that site contamination (if it exists) is below an appropriate standard; however, an environmental evaluation cannot be requested until the property has been sold or transferred. One result of this legislation is considerable extension of closure on real estate transactions. Additional problems include reluctance of state employees to approve cleanup plans and other issues related to establishing cleanup standards. It is clear that issues such as these will have considerable impacts on both remediation efforts and site development.

MAJOR FACTORS IMPORTANT IN THE DEVELOPMENT OF LAND USE PLANS FOR UNCONTROLLED HAZARDOUS WASTE SITES

This section considers the way in which future land use has been approached at some Superfund sites and other uncontrolled hazardous waste sites in the U. S. Information was obtained from RODs, other relevant reports, and case studies presented in Kingsbury and Ray (1986).

In contrast with that of the U.S., the approach to hazardous wastes sites remediation in the United Kingdom is based on future land use of the site. Although this approach sharply contrasts with that of the U.S., it necessarily highlights important considerations regarding land use of remediated sites. Therefore, some discussion of important factors regarding future land use gleaned from the United Kingdom approach is included. This information was obtained from various publications of the United Kingdom Department of the Environment, and articles and case studies reported by M. A. Smith (United Kingdom, 1983, 1987; Smith, 1982 a, b).

Factors Influencing Land Use Decisions at Some Superfund Sites.

Times Beach, Missouri. Times Beach was formerly an incorporated city located about 20 miles from St. Louis, Missouri. Historically the major land use was residential. The city supported minimal commercial use and no industrial development. The surrounding areas supported mixed residential and agricultural uses. The agricultural use was limited to cropland; no areas near Times Beach were used for grazing. In February 1983, on the basis of an advisory from the Centers for Disease Control, EPA permanently relocated Times Beach residents and businesses. The city was disincorporated in 1985.

The NPL site includes about 0.8 square miles. The site is bordered on the north and east by unincorporated areas of St. Louis County, on the south by unincorporated areas of Jefferson County, and on the west by the city of Eureka. To the north and east the site is adjacent to the Meramec River, which is the dominant hydrologic feature in the area. Much of the site is in the 5-year floodplain, and the entire site lies within the 25-year floodplain of the Meramec. The topography of the area is level to slightly sloping; average slope is less than 1 percent.

The contaminant of concern at Times Beach is 2, 3, 7, 8-TCDD, commonly referred to as dioxin. Site contamination resulted from spraying roads for dust control in the 1970s with oil that was contaminated with dioxin. Investigations at Times Beach found contamination limited to roads, road shoulders, and drainage ditches along the roads. Contamination, in general, is contained within the top 12 inches of the soil. Approximately 150,000 square yards (30 acres) of roadway and shoulder surface area are estimated to be contaminated with dioxin in excess of 1 part per billion (ppb). Furthermore, dioxin concentrations exceeding 100 ppb were detected on about 7,000 feet of roadways; levels exceeding 20 ppb were found on approximately 15,000 feet of roadways. Samples taken downstream of Times Beach are not contaminated with dioxin in any environmental medium. The greatest threat to human health at Times Beach is continued long-term direct contact with or ingestion of soils. The most serious environmental problem that could be anticipated at the site is the transport of dioxin to the Meramec River.

The Times Beach ROD, Section IX, "Summary of the Comparative Analysis of Alternatives" states, "A cleanup level of 20 ppb has been recommended by Federal and

State health agencies for the protection of public health at Times Beach, based upon non-residential land usage." Thus, it seems that the cleanup level selected for the site was based on future land use. The ROD provides the following justifications for cleanup levels based on nonresidential uses:

1) Contractual agreement and regulatory authority at federal and state levels are adequate to control future use and ensure that uses will be limited to nonresidential.

2) The location of Times Beach in the 5- and 25-year floodplains of the Meramec makes future residential development in the area impractical. In fact, the controlling factor in this situation seems to be physical site features; namely, location of the site within the 5- and 25-year floodplain of the Meramec River. EPA personnel indicated that the purchase of the property and relocation of the community resulted from threats associated with flooding of dioxin contaminated soils, not simply the existence of dioxin at the site.

3) The restoration of Times Beach to residential usage would not be cost effective. This decision was based on the considerable costs associated with protecting the site from future flooding, in addition to the measures required to remediate the dioxin contamination to acceptable levels for residential use. "The increase in value of the land at Times Beach with residential usage is not commensurate with the additional cost of restoring Times Beach to allow residential usage. There does not exist a financial incentive to restore Times Beach to allow future residential development" (U.S. EPA 1988a, b).

Another factor of considerable importance regarding future land use is the attitude of the local community towards the remedial action. At Times Beach, citizens were divided in their support for the selected remedy. The location of a mobile incinerator at Times Beach raised questions of possible health hazards associated with incineration, especially possible air and water pollution problems. In addition, there was considerable concern about the impact of construction and operation of an incinerator on the local economy. Citizens feared that the incinerator would create negative publicity about the area, depress the local economy, lower property values, and negatively affect local resort businesses. Interestingly, several public responses to the selected remedy suggested that the action proposed by EPA was too conservative. Some local residents suggested that dioxin levels at the site might not have negative health and environmental effects and that the appropriate action would be to tear down the site structures and maintain the site so that it would not appear derelict. While on the face these suggestions appear to address the issue of unnecessary fund expenditure by EPA to remediate the site, they also suggest public concern for negative publicity and local economy voiced in another way.

Thus, review of the ROD for Times Beach, Missouri, revealed that the issue of future land use was extremely important. In fact, the determination that future uses would not include residential use was critical in determining the ultimate cleanup level for the site. It is important to note that physical characteristics of the site (i.e., location in the 5- and 25-year floodplain of the Meramec River) strongly impacted the decision that future residential use of the land was inappropriate. Finally, the attitudes of the local community toward the remedy was regarded as important to the success of the remediation efforts.

Love Canal, New York. The Love Canal site is located in the southeast corner of the city of Niagara Falls, about 0.25 miles north of the Niagara River. The canal was originally excavated around the turn of the century as a power canal to provide cheap hydroelectric power for industrial development. This project was abandoned, however,

and between 1942 and 1952 the canal conveniently accommodated over 21,000 tons of various chemicals legally disposed of by Hooker Chemical and Plastics Corporation. The wastes deposited in the canal included acids, chlorides, mercaptans, phenols, toluenes, pesticides, chlorophenols, chlorobenzenes, and sulfides.

In 1953, the Niagara Falls School Board purchased 16 acres, including Love Canal, from the Hooker Chemical Corporation for the token sum of one dollar for construction of an elementary school. During the mid-1950s, homes and an elementary school were constructed on portions of the canal. By 1972, area lots were almost completely developed. Some of the lots directly abutted the landfill. Because the property was not directly conveyed to home owners by Hooker Chemical Corporation, the new property owners were unaware of the history of the site and the hazardous wastes buried there.

In the mid- to late 1970s, periods of high precipitation resulted in elevations of the local water table. Water transported the chemically contaminated leachate to the surface of the ground and into contact with basement foundations. Responding to complaints from residents whose homes abutted the canal, the New York State Department of Environmental Conservation and the EPA conducted studies on groundwater pollution and basement air and sump water contamination in late 1977. On the basis of data obtained from these studies, an order was issued by the New York Department of Health in 1978 to restrict access to the site and to remove surficial chemical contamination and cover exposed areas. Additional monitoring studies led both the New York State Department of Health and President Carter to declare a state of emergency at Love Canal in 1978.

In 1978 a three stage initial remedial action program was begun. The program included constructing a tile drain (leachate collection) system, placing a clay cap over the canal, and erecting an on-site treatment facility. In 1980, EPA constructed a 6 foot chain link fence to deter human and wildlife contact with contamination from storm sewer drainage from the canal while a removal was completed from both sides of the Black Creek. Later in 1980, President Carter declared a second state of emergency at Love Canal. This declaration was based in part on studies that indicated (though not conclusively) there might be an unusual level of chromosome damage in Love Canal residents. This factor coupled with results of other health and environmental studies led to the decision to remove families from the area. Following this action, an extensive environmental sampling program was begun.

The 1988 habitability report prepared for Love Canal represents the culmination of a 10-year effort to evaluate the risk posed to human health by hazardous wastes from Love Canal. Under the direction of the Love Canal Technical Review Committee, established by the EPA in 1983, a panel of non-government employed scientists developed criteria for determining the habitability of the Emergency Declaration Area (EDA). The EDA was a 232-acre area surrounding Love Canal from which more than 500 families were permanently relocated in 1980. The recommended criteria were reviewed by the public and a second panel of scientists. Proposed habitability criteria based on existing knowledge of toxicology were adopted by the Love Canal Technical Review Committee in December 1986.

Established criteria defined "habitable" as suitable for normal residential use without any restrictions. It was acknowledged that judgement of suitability for human habitation would require consideration of at least the following factors: "the degree of certainty about the presence or absence of risks; whether these risks are immediate or delayed, serious or negligible, voluntary or involuntary; and whether restricted habitability or alternative land use is intended" (N.Y. State Department. of Health,

1988). Several approaches to determining habitability were considered. The selected approach included sampling environmental media in the EDA and comparing the results with relevant federal or New York state standards, criteria, and guidelines and to the results of similar environmental sampling in similar communities in western New York not close to a waste site. Environmental sampling was specified to include dioxin in soil and indicator chemicals (termed Love Canal Indicator Chemicals or LCICs) in air and soil. Indicator chemicals selected were known to have been disposed of in Love Canal, and selection was based on persistence, potential for migration, and ability to be measured at low levels.

The criteria defined a habitable neighborhood as one meeting three conditions: the soil sample measurements are less than 1 ppb for 2,3,7,8-TCDD; the chosen aggregate values (e.g., mean, median, percentiles, etc.) of each LCIC evaluated both individually (univariate) and collectively (multivariate) are not significantly different from values obtained in comparison areas; and the neighborhood integrity will be preserved. A residence was considered habitable if three other conditions were met: it is located in a "habitable" neighborhood; air measurements demonstrate that re-testing and/or remediation are not required; and, if remediation is performed, it is shown to be successful (N.Y. State Department of Health, 1988). If no habitable neighborhoods could be defined, the criteria specified that the entire EDA would be judged uninhabitable.

Criteria also were established to delineate procedures for gathering and interpreting additional environmental data. Special provisions were established to allow for public and peer review, pilot studies, and restriction of habitability decisions until plans were developed to remediate creeks near Love Canal and the 93rd Street School (refer to U.S. EPA RODs May 6, 1985, October 26, 1987, and September 26, 1988). Special provisions also ensured that the security of Love Canal containment measures were reassessed to ascertain permanent containment and that safeguards were established to prevent further leakage from Love Canal.

The results of the habitability study are that three zones, EDAs 1, 2, and 3, do not meet the criteria for unrestricted residential use. Findings of significant differences between EDAs 1-3 and comparison areas imply additional risks from Love Canal chemicals to persons living in these areas. The areas would require remediation of contaminated soils to allow normal residential use; however, other uses such as commercial and industrial are not precluded by the findings. Zones EDA 4-7 are considered habitable according to the criteria. The study acknowledges that the absence of findings of significant differences between certain zones of the EDAs and comparison areas does not provide assurance that these areas are "risk free." "Both the criteria and the ultimate decision are bound by the limits of scientific knowledge about the impact of toxic exposures upon the health of our citizens. . . Nevertheless, government has a responsibility to exercise public health judgments on behalf of its citizens" (N.Y. State Department of Health, 1988).

Factors contributing to land use decisions that can be derived from the Love Canal Habitability Study include the following: decisions were made based on the best scientific information available; public participation was essential to the process; the process defined criteria associated with categories of land use and quality assurance standards for data collection and interpretation in advance.

It is worth noting that the previous use of Love Canal as a disposal area for toxic chemicals was acknowledged in the deed that conveyed the property to the city of Niagara Falls. The deed, in fact, contained a disclaimer specifying that Hooker

Chemical Corporation would not be held liable for damages associated with future use of the property. Furthermore, representatives of the Hooker Chemical Company, in writing and in public meetings, cautioned against the use of the property for public housing or a public school. This case has been pointed to repeatedly as the classic case demonstrating the ineffectual nature of institutional controls (i.e., deed restriction) in assuring future land use.

Bunker Hill, Idaho. The Bunker Hill site covers about 21 square miles in the Silver Valley of the south fork of the Coeur d'Alene River in northern Idaho. The site was added to the NPL in 1983. The area is contaminated by lead, zinc, copper, arsenic, and other toxic heavy metals dumped by local mining operations over the past 100 years. The local aquifer is severely contaminated with lead and zinc, and the South Fork of the Coeur d'Alene River also is contaminated.

The Bunker Hill facility operated a lead smelter from 1917 to 1982 and a zinc plant from 1928 to 1982. During this time particulates containing lead, zinc, and other heavy metals were discharged through stacks and dispersed over about a 40 square mile area. In 1981-1982 the facility closed due to poor market conditions. When the facility closed, over 2,000 employees lost their jobs. In 1982, the Bunker Hill complex was sold. The new owners indicated a desire to reopen the facility.

In 1974, two cases of undue lead adsorption in children from the town of Kellogg were reported. Follow up epidemiological studies of children in the Silver Valley revealed that significant numbers of children had elevated levels of lead in their blood. These studies identified the Bunker Hill lead smelter as the major source contributing to the elevated lead levels. Presently, the major risk of exposure to residents is believed to be through inhalation and ingestion of contaminated soils.

Area residents have not expressed major concerns about health risks due to the Bunker Hill facility. Although concerned about the health of their children, local residents do not seem to feel that operation of the Bunker Hill facility is really a public health threat. In fact, one of the primary community concerns is that operations at Bunker Hill will not resume. For this community, environmental and health issues are secondary to regaining employment.

At present the Bunker Hill site is unique in that the EPA has agreed to release a ski resort developer from all future liability under the Comprehensive Environmental Response, Compensation, and Liability Act. The unusual agreement will allow Von Roll Transport Systems Inc. and the city of Kellogg, Idaho, to develop a ski resort on part of the Bunker Hill site. In an effort to increase tourism in the area, the city of Kellogg has contracted with Von Roll Transport to construct a 3.1 mile aerial tramway to the ski area. The base of the tramway, a parking lot, and a terminal will be constructed on contaminated land. The covenant not to sue requires Von Roll Transport to install a 6-inch cap on the site. EPA reserves the right to take action if the developers cause existing problems to become worse or in the event of future releases of hazardous substances unrelated to existing contamination. EPA's determination is based on a judgement that construction with due care will likely have a beneficial environmental effect by encapsulating contaminated soils and is unlikely to exacerbate existing conditions or interfere with long-term remediation efforts. Furthermore, EPA recognizes the importance of this development toward rebuilding the economy of the Silver Valley.

Factors important to land use decisions at the Bunker Hill site include the measure of protection to health and the environment provided by the proposed development and the important community goal of reestablishing a viable economy. The concession of release from future liability illustrates the impact of the liability issue in redevelopment of remediated sites. The involvement of development interests in remediation and redevelopment efforts suggests possibilities for future solutions at other sites.

Luminous Processes, Georgia. A brief history of this site is included in Appendix B. This site is located in an industrial and commercial area in Athens, Georgia. Soils on the site were contaminated with radium-226. The remedial response options considered for the site included the preferred option, complete removal of the radioactive contaminants to ensure that radiation and radioactive material levels were reduced to acceptable levels; leaving the site and facility as is and restricting use and access to the site; establishing sedimentation and erosion control programs and restricting access and use of the site; and placing fill material over contaminated areas as shields for the radioactive materials. The ROD concluded that only removal of the radioactive contaminants offered permanent solution for the site. A number of factors led to the rejection of the other options based on cost effectiveness. The factors cited were the following:

(a) Legal problems associated with the state taking custodial control of the facility/site on a long-term basis.

(b) Operations and maintenance cost factors associated with the perpetual custody and care of the facility such as: Environmental Monitoring, Security, Radiation Control Program Administration, Site Facilities Upkeep and Maintenance, General Program Administration.

(c) Potential for migration of material from the site on a long-term basis.

(d) Potential health and safety implications resulting from accumulation of radon gases.

(e) Socio-economic factors, especially the impediment of growth in the area which could result from the lack of public confidence in a particular remedial option (U.S. EPA ROD for Luminous Processes, GA, 1982).

The ROD concluded that the cost of operation and maintenance and the devaluation of the site and adjacent properties demonstrated the economic undesirability of the alternatives to a removal action, the latter which would ensure that the site was suitable for release to unrestricted use by the general public.

Factors Considered in the Private Development of Remediated Uncontrolled Hazardous Waste Sites in the U. S. A recent publication by Kingsbury and Ray (1986) presents case studies of reclamation and redevelopment efforts at 16 uncontrolled hazardous waste sites in the U.S. A list of these sites is included in Appendix A. Two of the case study sites (Aidex Pesticide Facility, Iowa, and Chemical Metal Industries, Maryland) are Superfund sites.

The purpose of the 1986 study was to document the value of planning for land reuse in the design of hazardous waste remediation efforts. Objectives of the study included documenting specific instances where uncontrolled hazardous waste sites have been remediated and redeveloped; compiling information on criteria which have been used to guide hazardous waste cleanups; and examining the relationships between site reuse and the extent of remediation required (Kingsbury and Ray, 1986). Each of the case studies presented in the report involved remediation efforts undertaken or planned to upgrade

land use. Redeveloped uses included residential, recreational, commercial, institutional, and light industrial.

The extent of remedial action required to protect public health is influenced by numerous factors. Among the site-specific factors are climate, hydrogeology, and topography. The NPL mandates consideration of other factors including the types of chemicals present, potential for migration, degree of contamination, size of contaminated area, and cost of remedial action alternatives. Other important considerations are the location of the site relative to drinking water sources and population centers, potential social and economic impacts, and potential for redevelopment of the contaminated land.

The Kingsbury and Ray study identified two distinct types of redevelopment projects, public-initiated and private-initiated. It concluded that in public-initiated projects (including Superfund) public health issues are paramount, and, if site reuse occurs, it is incidental to cleanup. For most public-initiated remediations, cleanup efforts are so complicated and expensive that the economic value of the remediated site only partially (if at all) justifies the cleanup operation. When remediated sites pass into public ownership, reuse will probably be determined by the particular, immediate needs of the governing body when it assumes possession of the property.

In developer-initiated projects, funds that would have been used to purchase uncontaminated land are diverted into cleanup efforts. As any business expense would be, cleanup costs are passed on to the consumer. Therefore, the economic feasibility of developer-initiated projects may depend upon the cleanup standards established for a particular type of site redevelopment. The absence of cleanup standards and guidelines for most situations makes projection of remediation costs impossible. For this reason, developers generally regard reclamation and redevelopment projects as undesirable.

Furthermore, an important factor in the success of any redevelopment effort is public beliefs and attitudes toward the project. The publicity associated with Superfund sites often results in the public being suspect of remediation efforts. This serves as a further disincentive to private development of the site. In addition, the lengthy cleanup and litigation and the liability associated with Superfund sites discourages private development interests even after remediation efforts are completed at the site. It appears that Superfund sites may go unused for extended periods of time (several years typically) as cost recovery and ownership issues are litigated.

The Kingsbury and Ray case studies indicated that removal of contaminated soil and materials is the remedial action taken in most redevelopment projects. This is because the only guarantee, for municipality and developer, of site safety (i.e., zero risks) is complete removal of contamination. Treatment technologies are largely unproven and cannot achieve 100 percent detoxification or stabilization of the contamination.

If criteria based on "acceptable levels" of contamination are developed to guide site cleanup, these criteria must be applied with consideration to site-specific conditions. For example, requiring cleanup in urban areas to match conditions found in pristine environments is inappropriate. In addition, because the extent of cleanup required to protect human health varies with type of land use, standards and guidelines establishing what are regarded as safe levels of contaminants should be developed based on realistic exposure scenarios. In the case studies, deed restrictions seem to be the preferred means for enforcing land use restrictions over time.

An important conclusion of the Kingsbury and Ray study was that coordination of remediation and redevelopment efforts may provide opportunities to reduce project costs. If land reuse is decided before cleanup, it may be possible to tailor remediation efforts to accommodate site redevelopment or to develop design solutions that take advantage of some aspects of the remedial actions. For example, the Bolsa Chica site, Huntington Beach, California, a condominium development, illustrates a case where extensive excavation required for site cleanup was incorporated into the redevelopment plan by providing underground parking for the project. The design solution accommodated project needs and eliminated the need to fill the large excavation area.

Finally, an especially relevant conclusion of this report was that "There is a need for policy at the Federal level regarding redevelopment and reuse of uncontrolled hazardous waste sites" (Kingsbury and Ray, 1986). The study found that most states do not have the resources necessary to develop standards and guidelines for managing cleanup and redevelopment of hazardous waste sites. The program for guiding redevelopment of contaminated lands in California appears to be the most advanced nationally. Some components of the California program may provide models for other state and federal efforts.

Factors Considered in Land Use Decisions for Contaminated Sites in the United Kingdom. The following information is derived from the United Kingdom's Department of Environment Development of Contaminated Lands (United Kingdom, Department of the Environment, 1987) and case studies developed by M. A. Smith (1982a, b). This information is presented to characterize the contrast between the approaches of the United Kingdom and the U. S. to the problem of reclamation of contaminated lands and to point out the factors important to land reuse in the United Kingdom.

The emphasis in restoration of contaminated land in the United Kingdom is on beneficial reuse of the land for housing, pubic open space, agriculture, or industry. This emphasis results from pressure to ensure the social and economic well being of cities in which large, previously industrial areas are becoming vacant due to decline in traditional industries (such as steelmaking and docks) and the need to protect scarce agricultural land from unnecessary conversion to residential or industrial uses. According to government policy, it will rarely be acceptable in the United Kingdom to consider a site permanently ruled out for some beneficial use. In contrasting the United Kingdom and the U. S. approaches, Smith characterizes the U. S position:

> The other extreme can be represented by the concern in the U. S. for rapid remedial action on the very many "uncontrolled" hazardous waste sites that are already causing, or are seen as likely to cause, overt environmental damage, the prime example of which is Love Canal. Land tends not to be a scarce resource and the emphasis thus tends to be on "containment" or "isolation" of problems, and possible after-use is rarely a primary factor to be taken into account at the present time (Smith, 1982).

Recognizing that the two approaches represent opposite extremes, the United Kingdom approach can provide insights into remediation and redevelopment of contaminated lands possibly appropriate for consideration in developing land use policy in the U. S. In the United Kingdom, policies regarding land reuse are left to local planning authorities. The government provides various grants to encourage full and effective use of land in urban areas and reuse of previously developed sites. And, through the Department of Environment, the government provides guidelines to assist planning

authorities and developers in planning redevelopment projects. In the Development of Contaminated Land, contamination, or potential contamination, is described as "a material planning consideration which needs to be taken into account at various stages of the planning process including the preparation of development plans and the determination of planning applications" (United Kingdom, Department of Environment, 1987). The objective of planning is to strike a balance between health and safety risks and liabilities and the need to bring the land into beneficial use. The principal governing redevelopment of a contaminated site is that the redeveloped use should not subject site users, or any other target group, to avoidable risks (United Kingdom, Department of the Environment, 1983).

From the various guidelines, reports, articles, and case studies, three points valuable to land reuse issues may be extracted:

1. The United Kingdom approach addresses the redevelopment of contaminated land through site-specific planning by local planning authorities. Department of the Environment guidelines suggest that local planning authorities in preparing their development plans set out policies for the reclamation and reuse of contaminated land. It is further suggested that the development plans include detailed criteria to be applied in determining planning applications and site-specific proposals for land use (to be readily available to landowners, prospective purchasers, or developers).
2. The approach relies on initiative and funding from private development interests in the site investigation, remediation, and redevelopment of contaminated lands. It is accepted that such redevelopment efforts will result in higher costs to consumers. The central government contribution to redevelopment efforts includes providing development guidelines, technical advise, and reclamation and redevelopment grants.
3. This approach recognizes the importance of coordinated remediation and redevelopment efforts to achieve cost-effective solutions protective of human health. "The outstanding feature of contaminated land as a 'problem' is the vital need for a multidisciplinary and polytechnic approach at all stages" (Smith, 1982b).

FACTORS IMPORTANT IN THE DEVELOPMENT OF LAND USE POLICY FOR REMEDIATED SUPERFUND SITES

Previous sections have discussed some current policies and practices that may impact future land use at remediated Superfund sites and some major factors influencing land use decisions at previously reclaimed and redeveloped sites in the U.S. and United Kingdom. This section will present some important factors to consider in developing land use policy for remediated Superfund sites. In addition, possible goals and objectives for the development of land use policy will be suggested.

The following considerations all influence remediation efforts and ultimately redevelopment of Superfund sites.

1. **Limitations of current knowledge.** Knowledge is limited regarding the effects of existing hazards on human health and the environment over time, the cumulative environmental effects of numerous hazardous wastes sites across the nation and over time, and the effectiveness of remedies over time. The degree of uncertainty of the remedy as a permanent solution and the costs associated with future efforts to repair, replace, or modify the remedy are important considerations in remedy selection and in determining future land use.

2. **Limitations of resources.** Availability of technical expertise and funds limits remediation efforts at Superfund sites. These limitations require that difficult decisions be made in balancing cleanup efforts at many sites with the funds available for remediation. The probable outcome of remedial actions in terms of permanent protection of health and environment, costs of the actions, and public confidence in the actions must be weighed in remedy selection.

3. **Specific site characteristics.** Land use planning must recognize development opportunities and limitations resulting from location and physical characteristics (such as topography, hydrology, and geology) of the site, as well as impacts of hazardous wastes and residual contamination and site design opportunities and limitations associated with the remedy.

4. **Legal considerations.** Important legal issues must be considered, including the following: present and future liability associated with the site, property ownership following remediation, the length and cost of litigation to clarify such issues, and the ability of local governments to institute and enforce necessary land use controls.

5. **Social, political, and economic considerations.** Future land use must consider the needs and desires of local residents. The economic stability of the community, local planning goals and objectives, development pressures in the area, degree to which particular types of development will contribute to the community tax base, and local employment are all important factors in determining remedial actions and future land use. In addition, the attitudes and beliefs of local residents are important to the success of site remediation and redevelopment.

6. **Ethical considerations.** Decisions regarding hazardous wastes sites remediation and future land use will impact future generations, unborn children, and other life forms. The risks to health and the remediation costs that must be borne by these silent populations must be considered in policy development.

Why consider future land use--what functions could it serve? There is no official policy regarding the future use of remediated Superfund sites. RODs reflect uncertainty about how to handle the question of future land use and about implementation of land use controls when contamination remains on-site. However, beneficial reuse of land following remediation is undeniably desirable: it avoids threats to public health and safety posed by derelict or abandoned lands; it is likely to be more aesthetically pleasing (contributing to the healthy spirit of the community, as well as the economic well being, exemplified in the concerns of local residents in the area surrounding Times Beach, Missouri); it will contribute to the tax base of the community; it may contribute to the secure property values of surrounding landowners; and it may contribute to the economic stability of the community by supporting activities that provide employment to local residents.

To achieve these benefits, however, future land use must be appropriately related to the level of site cleanup. If all site remediations would result in perfect environmental restorations, the issue of future land use would not be of concern. Resource limitations including technology, personnel, and funds necessarily restrict cleanup efforts at Superfund sites. Remediations technologies do not yield 100 percent contamination-free environments. The number of sites on the Superfund NPL is increasing. If the Superfund program is to be successful, it is essential to develop remediation strategies that accomplish the legislative goals of protection of health and environment in an expedient and cost effective manner. It is also necessary to develop strategies that promote public confidence. Thus, two pressing concerns are the immediate risk to health and environment posed by the site and the safe future use of the land. It is possible that these fundamental concerns could be addressed by a strategy that addresses immediate hazards posed by the site, thereby containing the site, and then develops a long-term plan for the site guided by future redevelopment.

The principal goal of a land use policy should be to allow for the most effective allocation and utilization of available resources to meet the legislative purpose of protection of health and environment. Possible objectives of land use policy include the following:

- to make explicit what the federal position is concerning future use of remediated lands
- to support other federal and state comprehensive planning initiatives
- to provide a measure of accountability for consistency in either the process of remedy selection or in remediation of sites nationwide
- to encourage citizen participation in evolving a national consensus regarding acceptable and appropriate risks associated with hazardous wastes
- to assist in defining a reasonable level of expectation among local communities involved in site remediations
- to develop cleanup standards that encourage involvement of private development interests in site remediation and redevelopment
- to decrease cost of land reclamation by coordinating remediation and and redevelopment efforts
- to ensure future protection of public health by defining potential development options and/or setting standards that could allow future site redevelopment for more sensitive uses.

An official land use policy may serve to decrease the compromise of environmental goals for considerations such as whose paying for the remediation. A land use policy also could offer a means of distinguishing among remediation projects and promote effective allocation of resources. Remediating a site to a level of cleanliness unrelated to

future use may be unnecessarily expensive for private industry and the public, and it may not protect public health. For example, establishing cleanup levels based on residential use for a property located in a highly industrial area may unnecessarily inflate cleanup costs. If future use guides the setting of cleanup levels, however, it is essential that controls be implemented and enforced to ensure that future land use remains compatible with site remediation. Ultimately, two larger questions must be addressed:

- can long term land use restrictions really be protective of public health and the environment and
- what are the future costs to the environment, as well as those associated with loss of beneficial use of the land and long term operation and maintenance at the site?

The process of determining land use policy could offer a forum for public discussion, special interest involvement, and ultimately establishment of a national consensus regarding public health and safety issues and acceptable risks. Such public discussion would provide an opportunity to acknowledge scientific uncertainties and technological limitations in the reclamation of contaminated lands and in the assessment of public health and environmental risks. It could enhance public understanding and confidence in the remediation process, final site cleanup, and future land uses. Public discussion also might help to avoid lengthy and costly litigation related to specific site remediations by clarifying national goals and objectives related to future land use. Most sites cannot be made pristine; such a goal is presently unrealistic and perhaps unnecessary. We accept greater health risks living in an industrial society. In fact, urban dwellers and employees in some occupations accept even greater risks. (However, the issue of choice is an important one in this context. Because these people are typically less affluent, the question arises of whether the risks and benefits posed by industrial pollution are evenly distributed across society.) The question with Superfund sites is what is the range of acceptable risks? The question is complicated by factors such as background pollution levels. Any residual contamination level combined with already high background pollution levels may increase the risks beyond acceptable levels. Therefore, it may be necessary to consider not just the site, but the entire area in assessing health risks and determining cleanup standards and redevelopment opportunities.

Cleanup costs will often exceed the market value of the remediated property. Therefore, opportunities for private development interests to undertake site cleanups unaided are limited. It is possible, however, that some projects could be accomplished by private developers. Examples of such efforts include the previously cited California case studies by Kingsbury and Ray (1986) and the recent undertaking at the Bunker Hill site in Idaho. If cleanup levels (based on realistic exposure scenarios) associated with specific uses were available, developers might become involved in remediation efforts. By contrast, in areas where development pressures are significant, landowners and developers in some instances are "remediating" sites without consulting health officials or EPA. Clandestine cleanups make site identification difficult, may endanger other property (if hazardous wastes are removed to other locations), and thereby pose threats to public health and the environment. A policy addressing site redevelopment might serve to guide clandestine cleanup efforts or encourage developers to consult officials for assistance with site remediation.

Decisions regarding the use of land have rarely, if ever, resulted from logical and rational processes. In recent years, however, federal and state policies and initiatives have emerged that are directed toward comprehensive land use planning. To the extent possible, it seems that policy for reclaimed lands should support local land use planning goals and objectives. Although Superfund should not be paying for community growth across the country, it seems advantageous for the program to be consistent with other

federal and state policies and to support local planning goals and objectives for achieving economic stability and growth management.

A major consideration is what level(s) of government is appropriate for establishing, implementing, and enforcing land use policy for remediated Superfund sites. Previous discussion has suggested the need for federal level policy. The Superfund program is a federal initiative, and recent reports suggest that most state governments do not have policies or procedures for reclamation and redevelopment of hazardous wastes sites and are not capable of greater participation in the Superfund program (Kingsbury and Ray, 1986; U.S. Congress, OTA, 1985). Historically, land use decisions are decisions of local government. Practical considerations require that land use decisions be made at the local or regional level. Thus, any federal policy impacting future land use must incorporate local involvement in the planning process. The level of government responsible for implementing and enforcing policy decisions is critical to the effectiveness of the policy. Local governments, as previously discussed, are subject to various pressures which may undermine their resolve in matters of implementation and enforcement of land use controls. Therefore, it may be desirable that state level oversight programs be developed. Protection of public health and the environment and the cleanup remedy itself demand that necessary land use restrictions be observed in the future.

APPENDIX A
LIST OF CASE STUDIES BY KINGSBURY AND RAY (1986)

Hercules Properties, Hercules, California

Homart Development, South San Francisco, California

Bolsa Chica Site, Huntington Beach, California

Kellogg Terrace, Yorba Linda, California

Miami Drum Services Site, Miami, Florida

Kapkowski Road Site, Elizabeth, New Jersey

The Courtyard, Winooski, Vermont

Frankford Arsenal, Philadelphia, Pennsylvania

Chemical Metals Industries, Inc., Baltimore, Maryland

New York State Electric and Gas Corporation, Plattsburgh, New York

Aidex Pesticide Facility, Glenwood, Iowa

Gas Works Park, Seattle, Washington

Quendall Terminal, Renton, Washington

Boulevard Park, Bellingham, Washington

APPENDIX B

SURVEY OF SITES DELETED FROM NATIONAL PRIORITIES LIST

Information regarding these sites was obtained from the RODs; Remedial Investigations, and Feasibility Studies for individual sites; RODs Abstracts obtained from RODS DATABASE, (202) 245-3770; EPA Remedial Project Managers (RPMs) or other appropriate Regional contacts; state and local health and planning officials; and the following reports: Kingsbury and Ray, 1986; Nicholas, 1988; U.S. Congress OTA, 1985 and 1988. Where not otherwise indicated, quoted information is taken from ROD Abstracts.

The following sites have been deleted from the NPL.

Chemical Metals, MD
Cooper Road, NJ
Friedman Property, NJ
Harris (Farley Street), TX
Lehigh Electric & Engineering Co, PA
Matthews Electroplating, VA
Morris Arsenic Dump, MN
New Castle Steel, DE
PCB Spills, NC
PCB Wastes, Pacific Islands
Taputimu Farm, American Samoa
Tri-City Oil Conservationist, FL
Voortman Farm, PA
Walcott Chemical, MS
Chemical Minerals, OH
Enterprise Avenue, PA
Gratiot County Golf Course, MI
Krysowaty Farm, NJ
Luminous Processes, GA
Middletown Road Dump, MD
Mountain View Mobile Home Estates, AZ
Parramore Surplus, FL
PCB Warehouse, Saipan, Mariana Islands
Presque Isle, PA
Toftdahl Drums, WA
Varsol Spills, FL
Wade (ABM), PA

Deletion from the NPL indicates that the uncontrolled hazardous waste site has been remediated to a level judged by EPA to be protective of human health and the environment and that no further Superfund action is required at the site. Many of these sites represent EPA's early experience with CERCLA. Several RPMs indicated that some of these sites would not be listed on the NPL if they were discovered today because the nature of on-site contamination would be considered insufficient to require Superfund action.

Other information obtained during the course of this survey is summarized in the following general points.

1. Often EPA site contacts turned out to be assigned record keepers who had not participated in site remediation and, therefore, were unfamiliar with the sites. In general, record keepers are unaware of current site conditions and often unable to supply local or state contacts who would be familiar with the sites.

2. Attitudes among EPA personnel and local and state planning officials varied regarding site reuse concerns. Some RPMs pointed out that the mission of EPA with regard to Superfund sites is protection of public health and the environment in a cost effective manner. Future land use considerations were not regarded as a part of this mission. Some RPMs were reluctant to consider site redevelopment as appropriate if any contamination remained on-site. Other RPMs felt that future

land use is an important consideration, but that the federal government and EPA are not prepared to address this issue at present.

One of the planners interviewed pointed out that land use decisions have historically been a local decision, and should continue to be so, even though communities will require assistance to manage the difficult issues presented by hazardous wastes. An urban planner interviewed suggested that in some instances redevelopment would provide greater public health protection than present site operations (e. g., Quendall Terminal, Washington). A county planner indicated that local officials in his area do not believe they have the authority to regulate future development at a remediated site.

3. Most of the RODs for deleted sites (73 percent) indicate that removal of contaminated soil and materials for off-site disposal followed by no further action was the selected remedy. The few sites where institutional controls were implemented usually restricted groundwater use. In some cases where contamination remained on-site, no institutional controls were included in the ROD (Lehigh Electric and Engineering Co., Pennsylvania). In one case, institutional controls were proposed, but not implemented (Friedman Property, New Jersey).

4. Development pressures vary among the sites; however, private developers, as well as local governments, have expressed interest in redevelopment of some of the sites. Six of the deleted sites are partially or wholly owned by local or state governments and an additional four sites became the property of local or state governments during the remediation process (a total of 34 percent). Six of the sites (21 percent) remain under private ownership as before remediation. Six of the sites support the same use as before remediation; two of the sites support a similar or upgraded use. Two of the sites are described as vacant lots. Four of the deleted sites are located in residential areas, three in mixed residential and industrial or commercial areas, five in industrial or commercial areas, five in rural areas, one in a recreational area, three on Pacific islands, and the areas surrounding nine of the sites are unknown.

SITE SUMMARIES

1. Chemical Metals, Maryland: Deleted 12/30/82. Region III EPA Contacts: Kathryn Hodgkis, (215) 597-3480, and Neil Swanson, (215) 597-7937.

Site history; nature of contamination: The site is located in the interharbor area of Baltimore, an area of mixed industrial and residential uses. Threat of fire at the site lead to removal of contaminated soil and drums of stored chemicals.

Action(s): Contaminated soils and drums were removed from the site. Groundwater is contaminated; however, no treatment or monitoring were proposed.

ROD conclusion: No remedial action required after the removal action.

Land use restriction(s): None. Contaminated groundwater prohibits use for drinking.

Current status of site: The state of Maryland has located an office building on the site.

Project cost: Unknown.

Case studies of this site are included in the following publications: Kingsbury and Ray, 1986; U.S. Congress, OTA, 1985.

2. Chemical Minerals, Ohio: Deleted 12/30/82. Region V EPA Contact: Diana Mally, (312) 353-6287.

Site history; nature of contamination: The Chemical Mineral Reclamation site is located on the west side of Cleveland, Ohio. The site is bordered on the west by Memorial Shoreway West and to the north by the Old Cuyahoga River bed. Office buildings are located adjacent to the site, and residential development is across the Memorial Shoreway West. For about one year, the site housed a chemical reclamation facility where drums of waste solvents were mixed in vats and bulked for shipment. The reclamation operations ceased on July 2, 1980, when the warehouse was destroyed by fire. The fire was confined to the mixing-vat area of the building, but it caused a major air pollution problem, necessitating temporary closing of a section of the Memorial Shoreway West. After the fire, the city of Cleveland, concerned that the remaining sections of the building would fall on the drums of chemicals stored in the warehouse, had the 1,597 containers (ranging from 5 to 55 gallons) removed from the warehouse and staged outside on plastic sheets. The contents of the containers were inspected revealing paints, solvents, tar, grease, and resins. Further testing revealed polychlorinated biphenyls (PCBs) contamination of no more than 50 parts per million (ppm) in some of the drums.

Action(s): EPA approved funding for emergency action on 11/20/81. On 11/25/81, approval to proceed sampling drums and cleanup spilled material on-site was issued. Drums and contaminated soils were removed from the site.

Land use restriction(s): Unknown. A ROD abstract is not available for the site.

Current status of site: The city of Cleveland condemned the warehouse after the 1980 fire. The building was demolished, and the site remains a vacant lot.

Project cost: Capital costs of emergency action: $440,000; additional follow-up costs unknown.

A case study of this site is included in U.S. Congress, OTA, 1985.

3. Cooper Road, New Jersey: Deleted 02/21/89. Region II EPA Contact: Tamara Rossi, (212) 264-4593.

Site history; nature of contamination: The site consists of a 100 square foot dumping area in Voorhees Township, New Jersey. In 1982 several dozen 1 - 2 ounce glass vials (most intact) containing unknown liquids were discovered. Tests revealed the presence of benzene, ethylbenzene, xylene, naphthalene, and other contaminants.

Action(s): In June 1983 at the request of New Jersey Department of Environmental Protection the owners removed all vials and 6 inches of underlying soil.

ROD conclusion: The selected alternative is to take no further remedial action. Previous cleanup effectively and permanently addressed all public health and environmental concerns.

Land use restriction(s): None.

Current status of site: Unknown.

Project cost: Completed at property owners expense.

A case study of this site is included in U.S. Congress, OTA, 1988.

4. Enterprise Avenue, Pennsylvania: Deleted 03/07/86. Region III EPA Contact: Walter Graham, (215) 597-2193.

Site history; nature of contamination: The site, which is within the city of Philadelphia, encompasses about 57 acres located within the 100-year floodplain of the Delaware River. The site is contaminated with industrial and chemical wastes from unauthorized disposal of about 5,000 to 15,000 drums containing paint sludges, solvents, oils, resins, metal finishing wastes, and solid inorganic wastes.

Remedy: (1) Sampling and analysis of all soil stockpiled on-site in 100 cubic yard lots to determine disposal requirement; (2) off-site disposal at a RCRA approved facility of all soils failing the key indicator parameter test; and (3) backfilling, grading, and revegetating of the site as a final cover.

ROD conclusion: Off-site disposal alternative was selected as the most cost effective remedial action.

Land use restriction(s): None.

Current status of site: The site is owned by the local government. Present site use is unknown.

Project cost: Estimated capital costs: $4,324,000; annual operation and maintenance costs: $4,200.

5. Friedman Property, New Jersey: Deleted 03/07/86. Region II EPA Contact: Unknown.

Site history; nature of contamination: The site is an open, vacant lot with scrub vegetation, located in Upper Freehold Township, New Jersey. The site is bordered by a tributary to Lahaway Creek, a single-family residence, and routes 537 and 539. Between the late 1950s and the early 1970s, the site received bulk liquids and household and demolition debris. Information regarding contamination is limited due to impending litigation; however, pentachlorophenol and other volatile organics have been discovered in groundwater samples.

Remedy: (1) No action with regard to remediating low levels of on-site contamination; (2) monitoring of on-site wells annually for five years; and (3) recommendation that New Jersey request the appropriate local authorities to implement deed restrictions.

Land use restriction(s): EPA recommended that the state place deed restrictions on the property and prohibit agricultural and residential uses. Deed restrictions were not implemented.

Current status of site: A fence surrounds the property; however, it is regarded as vulnerable to redevelopment because it is located in a popular resort area with growth pressure.

Project cost: Capital cost: $60,000; operation and maintenance not specified in ROD abstract and unknown.

A case study for this site is included in Nicholas, 1988.

6. Gratiot County Golf Course, Michigan: Deleted 12/30/82. Region V EPA Contact: Jeff Gore, Pete Miller, (312) 886-6552.

Site history; nature of contamination: The site is about 1 acre, and it is the smallest component of two larger landfill and chemical sites. These sites have supported various industrial uses for over 100 years. The local town is small, and the golf course is located in a mixed use area. Residences border the golf course, and a landfill and industrial sites are adjacent to it. Both soil and groundwater were contaminated. According to EPA contacts, this site was not listed on the NPL.

Action(s): The golf course was excavated, and several million gallons of groundwater were treated. The site met requirements for clean closure.

ROD conclusion: A ROD abstract is not available for this site.

Land use restriction(s): None reported.

Current status of site: The site remains in use as a golf course.

Project cost: Unknown.

A case study of this site is included in U.S. Congress, OTA, 1985.

7. Harris (Farley Street), Texas: Deleted 04/18/88. Region VI EPA Contact: Tim Underwood, (214) 655-6730.

Site history; nature of contamination: The site is located in a primarily industrial area (few houses are located nearby), just north of what was Ellington Air Force Base. The site consists of two trenches, about 170 feet by 30 feet and 150 feet by 25 feet, contaminated with styrine tars. There was no surface or groundwater contamination detected on-site. The DOW Chemical Company remediated the site.

Action(s): All contamination was removed from the site.

ROD conclusion: A ROD abstract is not available for this site.

Land use restriction(s): None.

Current status of site: Houston does not have zoning regulations; however, the site is located in a primarily industrial area. The land remains in private ownership. The owner also owns the Class IV construction landfill which surrounds the site. The site was to be incorporated into the landfill after remediation.

Project cost: Unknown.

8. Krysowaty Farm, New Jersey: Deleted 02/21/89. Region II EPA Contact: Larry Granite, (212) 264-7668.

Site history; nature of contamination: The site is located on a 42 acre tract in Hillsborough, New Jersey. Between 1965 and 1970, chemical wastes disposal was reported to have occurred at the site. An estimated 500 drums of paint and dye wastes were dumped, crushed, and buried at the site. Other wastes dumped on-site included demolition debris, tires, automobiles, bulk waste, solvents, and waste sludge.

Remedy: (1) Excavation and removal of waste disposal area; (2) transport and disposal of waste to approved PCB disposal facility; (3) provision of a permanent alternative water supply for potentially affected residences; and (4) monitoring of on-site wells semi-annually for five years.

Land use restriction(s): None noted in the ROD abstract; however, the Federal Register (Vol. 53, No. 202, 10/19/88) deletion notice reported that two institutional controls have been implemented. A zoning ordinance implemented by the Hillsborough Township precludes land development due to the slope of the remediated area. A mandatory water connection ordinance prohibits private well installation and use at the site.

Current status of site: Unknown.

Project cost: Capital cost: $2,164,014; operation and maintenance costs: $145,698.

9. Lehigh Electric and Engineering Co., Pennsylvania: Deleted 03/07/86.
Region III EPA Contact: Walter Graham, (215) 597-2193.

Site history; nature of contamination: The site is approximately 4.4 acres adjacent to the Lackawanna River in Old Forge, Pennsylvania. The site housed an old coal breaker and steam generation facility; however, from the early 1960s the site was used as an electrical equipment repair and storage yard. During that time PCBs contaminated dielectric fluids from transformers and other electrical equipment were spilled on-site. Contamination at the site consists of PCBs in surface soil, concentrations ranging from undetectable to 110,000 ppm. EPA Region III became aware of the site in March 1981.

Action(s): Following initial field inspections, which revealed high levels of PCBs in the soil, a fence was constructed to contain the contamination zone. The fenced property extended onto adjacent properties and included about 6.4 acres. During 1981-1982, equipment located at the site was removed.

Remedy: (1) Excavation and off-site disposal of soils with PCB concentration of 50 ppm or greater; (2) Additional soil excavation and removal where cost-effective; (3) Demolition of the 2 buildings on-site; and, (4) Backfilling, grading, and revegetating the site to minimize erosion and control percolation and run-off.

Land use restriction(s): No land use restrictions were specified in the ROD.

Current status of site: Unknown.

Project cost: Capital cost: $6,401,000; operation and maintenance over a 30 year period: $46,000.

The following information is excerpted from Nicholas, 1988, pp. 25-27:

> At Lehigh Electric and other sites, efforts by individuals to develop sites with residual onsite soil or groundwater contamination has forced officials to face the question of future land use.
>
> The Lehigh Electric site in Old Forge, PA was an industrial plant near the Lackawanna River where extremely high concentrations of PCBs were found in the soil, some up to 110,000 ppm.(18) The remedy includes removing all soils on site with concentrations up to 50 ppm of PCBs, and then removing hot spots of PCB concentrations over 10 ppm where "cost effective."(19) The remedy also calls for grading and filling the site, dumping excavated soils in an EPA approved landfill offsite, and capping the soil with a clay cam.(20) No institutional controls were mentioned in the ROD. During the public hearings before the ROD was signed, the subjects of how complete the soil removal should be and of future land use were brought up by citizens who wanted all soils above 10 ppm PCBs removed from the site: "EPA can not give us any written guarantees about our future, and we are intelligent enough not to ask for any,. . . but there is such a thing as

preventive measures, and this is all we are asking for," (21) and, "Remove the price tag from our heads and allow us to return to our lives on an almost normal basis again - for we can never go back to the happy-go-lucky people we once were."(22)

Not long after the ROD was signed, Region III discovered a buyer was interested in purchasing the site and had plans for an unknown development there. Region III queried EPA headquarters on what restrictions they were authorized to impose on future land use at the site to protect the integrity of the clay cap. In his response to Region III, Hazardous Waste Branch Chief Neil Wise concluded that the federal government had no authority to restrict the land use of a private property owner, but added that CERCLA liability could be incurred by anyone who damaged the site remedy - an after-the-fact dissuasion. The text of Wise's response follows, and is applicable to similar sites:

> Although there are no provisions in CERCLA or SARA for such restrictions once a site has been remediated, the integrity of any cap or other "permanent" installation can and should be ensured by the O & M responsibilities of the state.
>
> Land use is typically a local zoning matter. CERCLA is a remedial authority; the government can spend money to protect public health and the environment, but we do not have the authority to restrict land use once our work is done. Of course, any user of the land who interferes with the remedy, e.g. disturbing the clay cap, could
>
> As for the Lehigh Electric site, the federal government has no control over the sale of such site. Speculation over potential use or activities at the site is insufficient justification to interfere. A purchaser should, however, be on notice of the past problems and remedies. Future owners are more likely to have notice of the remedial action if the state or local government records the

10. Luminous Processes, Georgia: Deleted 12/30/82. Region IV EPA Contact: Al Cherry, (404) 257-7791.

Site history; nature of contamination: The site consists of an area of about one acre near Athens, Georgia. From 1952 until 1978, Luminous Processes, a manufacturing facility using radioactive radium-226 and tritium to paint watch and clock dials, occupied the site. The facility was essentially abandoned by the owner in 1980. At that time, analysis of on-site soil and vegetation showed that significant levels of radioactive radium-226 and tritium existed at several locations throughout the property.

Action(s): Action at the site included the excavation and off-site disposal of 18,015 cubic feet of soil and materials contaminated with radium-226, up to 2,000 picocuries per gram of soil; removal of contaminated structures inside the building; and removal of contaminated soil and materials in adjacent septic tank tile field areas. Excavated areas were backfilled, seeded with grass, and limited to public access.

ROD conclusion: "To summarize, all of the objectives for the Luminous Processes cleanup were met or surpassed during cleanup activities. . . the site has been restored to what most believe to be better-than-original condition" (Georgia Department of Natural Resources, 1982).

Land use restriction(s): At the time the EPA action was taken, the site was placed under closed access to the public because the building had structural problems constituting a safety hazard. No permanent land use restrictions were instituted.

Current status of site: The site is located in a well developed commercial area and supports a local business facility.

Project cost: $812,921.

A case study of this site is included in U.S. Congress, OTA, 1985.

11. Matthews Electroplating, Virginia: Deleted 01/19/89. Region III EPA Contact: Paul Leonard, (215) 597-8257; Roanoke County Health Department: Dick Tabb, Sanitarian, (703) 857-7807; Roanoke County Planning and Zoning Department: Tim Beard, Associate Planner, (703) 772-2088.

Site history; nature of contamination: The site is 1.7 acres in Roanoke County, Virginia. Between 1972 and 1976, two buildings housed an automobile bumper electroplating operation. The site was reported to EPA in 1982. On-site groundwater monitoring revealed heavy contamination with hexavalent chromium. Off-site groundwater testing revealed that 10 local residential wells were contaminated with chromium.

Remedy: The cost effective remedy selected was to provide municipal water service to the affected neighborhood.

Land use restriction(s): None were specified in ROD; however, Roanoke County has restricted the area such that no private wells are allowed for residential use.

Current status of site: The site is zoned A1, Agricultural. This category allows a variety of agricultural, as well as residential, uses. The county requires use of the municipal water supply for residential purposes. The area is under private ownership. The county planner expressed concern about residential use of the site; however, he indicated that the county is not presently considering implementing controls to restrict development for fear of suits on the grounds of a "taking."

Project cost: Capital costs estimated to be $662,000; present worth of operation and maintenance for 30 years: $292,000.

12. Middletown Road Dump, Maryland: Deleted 04/18/88. Region III EPA Contact: Paul Leonard, (215) 597-8257; Maryland Health Department: Ronnie Larmore, Sanitarian, (301) 631-3447.

Site history; nature of contamination: The site is an approximately 2.3 acre, privately owned waste dump located in a residential area near Annapolis, MD. For several decades, the site operated as a dump without proper state permits. In 1981, about 40 drums and four dumpster loads of suspected hazardous substances were discovered on-site.

Action(s): In 1983, immediate removal measures included the following: removal of 68 drums, 70 contaminated tires, 610 tons of contaminated soil, and pails that held 5 gallons of marine paint; soil sampling to confirm adequate contaminant removal; installation of six groundwater monitoring wells around the perimeter of the site; drum sampling and testing and relocation of one million tires on-site to allow more comprehensive subsurface investigation.

Remedy: (1) No action with regard to remediation on-site; and, (2) Maryland will monitor on-site wells at least annually as part of an existing closed waste site inspection schedule.

ROD conclusion: The findings of a remedial investigation conducted after the 1983 actions found no risk to receptors via direct contact, inhalation, or ingestion; therefore, a no action remedial alternative was selected.

Land use restriction(s): None.

Current status of site: The site is privately owned. The owner continues to live in his private residence which is located on the site. The residential area surrounding the site is experiencing a lot of construction.

Project cost: 1983 action cost: $384,000; no additional costs were specified in the ROD abstract.

13. Morris Arsenic Dump, Minnesota: Deleted 03/07/86. Region V EPA Contact: Gene Wong, (312) 886-6337.

Site history; nature of contamination: The site is an area approximately 100 feet by 200 feet, located in Stevens County, about 1 mile NE of Morris, Minnesota. The area is primarily rural, and land use is agricultural. In the early 1940s, about 1,500 pounds of arsenic-laced grasshopper bait was reportedly buried in a gravel pit near the intersection to highways 28 and 59. Subsequent highway construction has made location of the burial site difficult. It is assumed that the arsenic was mechanically distributed during highway construction because excavated top soil was relocated to highway side slopes after roadbed preparation.

ROD conclusion: "The site poses no imminent health hazard to the public due to the direction of groundwater movement from the site and the minimal population concentration within the site specific area. In addition, levels of arsenic found in the soils at the site are within the range of natural levels of arsenic in soil. Therefore, since the site poses no significant threat to public health, welfare or the environment, the 'no-action' alternative was selected".

Land use restriction(s): None specified in the ROD abstract; however, Mr. Wong indicated that groundwater use is restricted (monitored by the state agency responsible for well permitting), and property deeds contain notification that there was once an arsenic contamination problem at the site.

Current status of site: Part of the site is owned by the Minnesota Department of Transportation; part of the site is in private ownership. The Minnesota Department of Transportation property continues to be highway right-of-way.

Project cost: No costs were specified in the ROD abstract.

14. Mountain View Mobile Home Estates, Arizona: Deleted 04/18/88. Region IX EPA Contact: Greg Baker, Chief for Federal Response Section, (415) 454-9252; Arizona Department of Environmental Quality: Simon Navarro, Manager for Remedial Projects Unit, (415) 257-2342.

Site history; nature of contamination: A residential subdivision of mobile homes supporting about 130 people was established on the site in 1974. The homes were located on graded asbestos tailings and contaminated soils remaining from the site's previous use as a metate asbestos company mill. The mill processed asbestos ore from 1953 until it was closed in 1974 for failure to meet air quality standards. Residents of the subdivision were exposed to asbestos fibers from contaminated soils and potentially from the fiber piles of an adjacent asbestos mill.

Remedy: (1) Permanent relocation of subdivision residents: (2) on-site burial of containerized mobile homes; and, (3) site closure by capping, fencing, and maintenance.

Land use restriction(s): See below.

Current status of site: The site is owned by the state of Arizona. The site is fenced, and there are no plans for redevelopment of the site. The state will continue to monitor the site.

Project cost: Estimated Capital and operation and maintenance costs at present worth for the project life: $4,432,000.

15. New Castle Steel, Delaware: Deleted 03/17/88. Region III EPA Contact: Laura Boornazian, Chief MD/DE Section, (215) 597-9118 (It was not possible to contact Ms. Boornazian during the course of the study).

Site history; nature of contamination: The site is a 3-acre disposal dump in New Castle, Delaware. Since its operations began in 1907, the Deemer Steel Company periodically spread solid wastes over the surface of the disposal area. The wastes consist primarily of black sand which may contain small quantities of bentonite and corn flour. About 2,430 tons of black sand were generated annually . Other company wastes disposed in the area included slag, coke, iron oxide, fine sand dust, and metal scrap. In addition, electric furnace dust (about 9.6 tons per year) were disposed of on-site between 1973 and 1980. In 1980, the electric furnace dust was found to be EP-toxic for cadmium, chromium, and lead. A 1984 report found the thickness of wastes in the fill section to range from 8 to 13 feet; average thickness was about 10 feet. The

wastes were disposed on an area of predominantly unconsolidated marsh sediments, underlain by approximately 50 feet of low-permeability clays. An important drinking water source, the uppermost Potomac aquifer, lies about 70 feet below the site where it is protected from contamination by the low-permeability clay layer.

ROD conclusion: EPA concluded from an endangerment assessment based on samples collected in January 1987 that there was no significant risk to human health and the environment attributable to the site. "The selected remedial action for this site is no further action."

Land use restriction(s): None identified in the ROD abstract.

Current status of site: Unknown.

Project cost: None.

16. Parramore Surplus, Florida: Deleted 02/21/89. Region IV EPA Contact: Beverly Houston, (404) 347-2643.

Site history; nature of contamination: The site is about 25 acres in Mt. Pleasant, Florida, housing Parramore Surplus Company. This is an active facility that stores and resells surplus government products. Most of the site is used for vehicle and equipment storage. In 1982, the Florida Department of Environmental Regulation inspected the Parramore site and discovered an estimated 400 to 600 drums stored on-site, many of which were leaking and killing surrounding vegetation.

Action(s): In response to the 1982 state inspection, Parramore Surplus Company conducted a limited cleanup, including the removal of hazardous chemicals and contaminated soils.

Remedy: (1) No further remedial actions will be taken on soil contamination; (2) no remedial actions will be taken on groundwater; and (3) groundwater quality assessment will be conducted to assure that past site activities have not impacted groundwater. If the results of the groundwater quality assessment reveal contaminant levels exceeding allowable concentrations, a detailed investigation will be initiated. If contaminant levels do not exceed allowable concentrations and do not pose a significant or imminent threat to human health, no further action will be taken.

Land use restriction(s): None.

Current status of site: Private ownership; unknown use.

Project cost: Estimated capital costs: $21,000; Annual operation and maintenance costs: $19,000.

17. PCB Spills, North Carolina: Deleted 03/07/86.

ROD conclusion: No ROD abstract exists for this site.

18. PCB Warehouse, Saipan, Mariana Islands: Deleted 03/07/86. Region IX EPA Contact: Bill Lewis, Senior On Scene Coordinator, (415) 454-7464; Norm Lovelace, (415) 974-7431 (It was not possible to contact Mr. Lovelace during the course of the study).

Site history; nature of contamination: Various sites in the islands were found to be contaminated with PCBs. The sites were treated in one emergency removal action. Most of the land involved is owned by local island governments.

Action(s): Transformers stored in the warehouse were either buried or removed, depending upon the level of contamination.

ROD conclusion: No ROD exists for this site.

Land use restriction(s): None.

Current status of site: Unchanged from before the action was taken.

Project cost: Unknown.

19. PCB Wastes, Pacific Islands: Deleted 03/07/86. Region IX EPA Contact: Bill Lewis, Senior On Scene Coordinator, (415) 454-7464.

Site history; nature of contamination: Various PCB contaminated sites were located on different islands in the Pacific. The sites were treated as one emergency removal action. Most of the land involved is owned by local island governments.

Action(s): Emergency removal of PCB contaminated transformers.

ROD conclusion: No ROD exists for this site.

Land use restriction(s): EPA requested that the local government restrict one piece of PCB contaminated property.

Current status of site: Unchanged from before the action was taken.

Project cost: Unknown.

20. Presque Isle, Pennsylvania: Deleted 02/13/89. Region III EPA Contact: John Banks, (215) 597-9562.

Site history; nature of contamination: The site is located on the Presque Isle State Park Peninsula in Erie, Pennsylvania. The site is about 100 square feet and consists of an abandoned natural gas well. In the early 1970s, the Erie County Health Department discovered a seep discharging a noxious, hydrogen sulfide-bearing black liquid. Investigations attempted to determine if the liquid was naturally occurring or related to the deep well injection of spent paper pulping liquid by a nearby paper mill.

Action(s): The natural gas well was plugged in 1982.

ROD conclusion: Investigations subsequent to the plugging of the well in 1982 revealed no further release of the hazardous liquid. EPA determined that no significant risk or threat to public health and the environment exists; therefore, no further action will be taken at the site.

Land use restriction(s): None specified in the ROD abstract. Notification is provided to natural gas and oil drillers that they may encounter hydrogen sulfide.

Current status of site: The site remains part of the Presque Isle State Park; access is unrestricted.

Project cost: None.

21. Taputimu Farm, American Samoa: Deleted 03/07/86. Region IX EPA Contact: Bill Lewis, (415) 454-7464 or Chris Weden, (415) 454-8132 (It was not possible to contact Mr. Weden during the study).

Site history; nature of contamination: The Taputimu Farm is on the Island of Tutuila, which is approximately 25 miles by 3 miles with a population of 32,000. The site is owned by the government of American Samoa and is located about 0.25 miles from a public beach. The site is part of an agricultural experimental farm owned by the Territory, and it consists of a warehouse constructed of plywood and corrugated metal. The facility was the primary repository of unused and out-dated agricultural chemicals and pesticides for about 10 years. Approximately 2,000 pounds of hazardous wastes were stored on-site. The warehouse, located in a depression about 100 feet above sea level, floods regularly. Possible human contact with contaminated materials, as well as contamination of marine resources and drinking water, are of primary concern.

Action(s): Remedial action consisted of (1) repacking or overpacking stored chemical/pesticide materials; (2) decontamination of storage facilities and sealing decontaminated surfaces; and (3) transporting of all waste materials to the U.S. mainland for disposal.

Land use restriction(s): None.

Current status of site: Remains the property of the government of American Samoa.

Project cost: Capital costs: $160,000.

22. Toftdahl Drums, Washington: Deleted 12/23/88. Region X EPA Contact: Cindy Colgate, Environmental Protection Assistant, (206) 442-1815.

Site history; nature of contamination: The site is a rural property of about 15 acres, located in Clark County about 4 miles east-southeast of Battleground, Washington. General land use in the area is rural residential. Most of the homes in the area obtain water from wells that are screened at least 70 feet below the surface. The property owner is alleged to have delivered 100 to 200 drums containing industrial wastes to the site in the early 1970s. He apparently cleaned most of the drums on-site and disposed of them off-site and subsequently buried 50 drums containing unknown amounts of industrial wastes in a trench about 500 feet from the cleaning location. The buried drums were discovered in the mid-1970s by new property owners. From 1978

to 1982, about 38 drums were removed by the previous owner. Another 12 drums were reburied at another location on-site.

Action(s): In 1982, the Washington Department of Ecology was notified that drums had been buried on the site. The following actions were taken by that department. A 1983 investigation located about six crushed and badly rusted drums on-site. A fence was placed around the drum burial area, and additional soil and surface and groundwater sampling was undertaken. Twenty exploratory pits were dug inside the fenced area. Five crushed drums and parts of additional drums were unearthed. The drum remains, together with 40 cubic yards of visibly contaminated soil, additional waste materials, and decontaminated water, were disposed of off-site. Additional sampling revealed some contaminants at the site including metals, volatile organic compounds, base/neutral organic compounds, cyanides, and PCBs. However, soil samples revealed no significant inorganic contaminants, and the only significant concentrations of organic contaminants were non-priority pollutants, which were probably not related to site contamination. The conclusion of surface water sampling was that if movement of contaminants off the Toftdahl site is occurring, the magnitude of the effect is quite small. Groundwater tests showed the concentrations of the metals at and near the Toftdahl site to be uniformly higher than the regional background values; however, no significant violations of drinking water standard for the inorganic waste indicator constituents were found in any monitoring well .

ROD conclusion: The remedy included: (1) no further action to remediate the site; and (2) Washington Department of Ecology will analyze groundwater samples from existing monitoring wells and private residential wells semi-annually for five years and then annually for 10 years, subject to funding by the Washington State Legislature.

Land use restriction(s): None.

Current status of site: Unknown.

Project cost: None.

23. Tri-City Oil Conservationist, Florida: Deleted 09/01/88. Region IV EPA Contact: Camilla Warren, (404) 347-2643 (It was not possible to contact Ms. Warren during the course of the study).

Site history; nature of contamination: The site is about 0.25 acres, located in Hillsborough County, Florida. From 1960 to 1975, a Heating Oil Service Business was located at the site. From 1978 to 1983, the site was a center for waste oil collection and distribution. In 1982, there was a spill of about 3,000 gallons of waste oil. The spill occurred within 0.25 miles of at least eight private drinking water wells and within 2 miles of a major supply of public drinking water. The property owner failed to clean up the site as requested by the Florida Department of Environmental Regulation.

Action(s): In 1984 and 1985, the state of Florida removed contaminated soil and sludge threatening groundwater in the area.

ROD conclusion: The removal actions by the state of Florida resulted in contaminant levels below area standards; therefore, no further action was the selected alternative.

Land use restriction(s): None were specified in the ROD abstract.

Current status of site: Unknown.

Project cost: None to the program.

24. Varsol Spills, Florida: Deleted 09/01/88. Region IV EPA Contact: Jim Orban, (404) 347-2643.

Site history; nature of contamination: Varsol Spills site is one of three Biscayne aquifer hazardous waste sites on the EPA NPL addressed as one management unit for a remedial investigation and feasibility study. The Biscayne aquifer is the sole source of drinking water for 3 million residents of southeast Florida. The Varsol Spills site is located in the northeast section of Miami International Airport. Industrial operations on-site have resulted in hydrocarbon contamination of surface and groundwater in the airport area. Since 1966, approximately 15 spills and leaks have resulted in release of about 2 million gallons of hydrocarbon, including an estimated 1.5 million gallons of varsol. In 1970, an unknown amount of jet fuel spilled into a drainage canal on-site. Construction activities in 1981 revealed a thick hydrocarbon layer floating on the water table in an excavated trench.

Action(s): After the 1981 discovery of hydrocarbon floating on the water table, monitoring wells were installed by one of the responsible parties and Dade County, and operations were undertaken to recover the jet fuel.

ROD conclusion: "The remedial investigation of the site showed no trace of varsol in and around the airport at this particular time, thus the recommended action for this site is no action".

Land use restriction(s): None.

Current status of site: Continued use as part of the Miami International Airport.

Project cost: None to Superfund; unknown private expenditure.

25. Voortman Farm, Pennsylvania: Deleted 05/31/89. Region III EPA Contact: Walter Graham, (215) 597-2193.

Site history; nature of contamination: The site consists of a sinkhole located on the 43 acre Voortman Farm in Upper Salucon Township, Pennsylvania. In late 1979 and early 1980, empty battery casings were disposed of in the sinkhole. In 1986, the battery casings caught on fire. Attempts to extinguish the underground fire were unsuccessful for several days until access could be achieved. When access was attained, the burning wastes were excavated and extinguished. Additional wastes and residues were excavated from the sink hole and disposed of off-site. Collapse of the walls of the sink hole resulted in a natural cap at the site.

Remedy: The selected remedy included: (1) "No action alternative with continued groundwater monitoring," (2) EPA and DER will monitor on-site groundwater for metals related to the disposed wastes; (3) groundwater will be monitored for five years at which time the site will be reviewed to determine need for continuing monitoring; and (4) no further treatment of groundwater, surface water, sediments, or soils will be required.

ROD conclusion: Removal of burning battery casings, ashes, and soils effectively eliminated the source of future threats to groundwater quality.

Land use restriction(s): None reported in the ROD abstract; the site is a sink hole, which severely limits land use.

Current status of site: Unknown.

Project cost: Present worth capital costs: $26,000; annual operation and maintenance: $6,860.

26. Wade (ABM), Pennsylvania: Deleted 03/23/89. Region III EPA Contact: Walter Graham, (215) 597-2193; Pennsylvania Federal Funded Site Section (Superfund): Don Becker, Chief, (717) 783-7816; Chester, Pennsylvania, Health Department: David Chakabarty, Health Officer, (215) 447-7770; Chester, Pennsylvania, Zoning Department: Lee Morrison, Director of City Planning, (215) 447-7881.

Site history; nature of contamination: The site is a 3-acre parcel located on the banks of the Delaware River, 9 miles south of Philadelphia. The area is industrial; the site is bordered by a power plant on one side and a refinery on the other. From about 1950 until the early 1970s, the site was the location of a rubber recycling facility. In the early 1970s, the site was converted to an illegal industrial waste storage and disposal facility. Soils and groundwater are severely contaminated by the direct emptying of drums of waste onto the ground and into trenches. About 150,000 gallons of waste chemicals remained at the site.

Remedy: (1) remove and dispose of tires and tankers; (2) remove on-site waste piles; (3) demolish buildings, allow slabs to remain intact, use demolition material for fill on site; (4) test, remove contents, and close two underground storage tanks; (5) remove and dispose of contaminated soil; (6) cover the site with topsoil and seed the area; and (7) continue operation and maintenance of the site.

Land use restriction(s): None.

Current status of site: The title to the property remains in the owner's name (Mr. Wade) ; however, EPA and Pennsylvania have filed liens to recover cleanup costs. The property cannot be sold until the liens are satisfied. If the liens are not satisfied, after properly notifying EPA, the state will offer the property for sale to recover taxes.

In Pennsylvania, land use is basically controlled by local government, not the state. Previous to 1988, no mechanism existed for implementing deed restrictions or notices to inform future property owners of past hazardous wastes contamination. In October 1988, Pennsylvania enacted legislation requiring that a notice of the nature of a contaminated site be included in the property deed (Act 1988-108, Hazardous Site Cleanup Act).

The Wade site is zoned M3, the heaviest industrial use category. A variety of uses have been proposed for the property by the city of Chester, Pennsylvania . The ones reported included location of a resource recovery plant, light industrial use such as a truck farm, and recreational use. As the groundwater is contaminated, any future use

would not allow groundwater use. Some concern was expressed about industrial use because of disturbance of the soil cover.

Project cost: Unknown.

27. Walcott Chemical, Mississippi: Deleted 12/30/82. Region IV EPA Contact: Gina Townsend, (404) 347-5065 (Ms. Townsend informed me that this site did not make it onto the NPL [even though it appears on EPA's published list of Deleted NPL Sites]. Information regarding this site was obtained from a Project Plan for Sampling at Walcott Chemical Company Warehouse prepared by Neal B. Strickland, Ecology and Environment, Inc., submitted to R. D. Stonebraker, July 8, 1981).

Site history; nature of contamination: The site is located on the corner of North and Alexander Streets in Greenville, MS. Since the early 1960s when the Walcott fertilizer mixing plant closed, the site has been inactive. A 200 feet by 75 feet warehouse on-site contains from 240 to 260 55-gallon drums and numerous bags of various chemicals, including: mineral spirits, n-butyl alcohol, cutting alcohol, formic acid, tetrasodium pyrophosphate, calcium hydrochlorite, caustic soda, acid delinted cotton seed, lime, and borax. The storage drums are in various states of deterioration. The main hazard associated with the warehouse is accidental combustion with the potential devastation of nearby residences and businesses. Presently the site is owned by the state due to the owner's neglect in paying property taxes.

Action(s): After investigation by EPA in July 1981, the property owner removed wastes to a land disposal facility.

ROD conclusion: In July 1982, the site was judged clean. A ROD abstract is not available for this site.

Land use restriction(s): None were noted in the case history presented in the U.S. Congress, OTA, 1985 report.

Current status of site: Unknown.

Project cost: Unknown.

A case study of this site is included in U.S. Congress, OTA, 1985.

LIST OF CONTACTS

U.S. Environmental Protection Agency

Headquarters

Marlene Berg, Environmental Scientist	(202) 475-9493
Debbie Lebow, Acting Chief, Guidance and Oversight Branch, Enforcement Division, CERCLA	(202) 475-8235
Deborah Martin, Chief, Policy Analysis Branch, OSWER	(202) 382-2756
Vanessa Musgrave, Superfund Community Relations Coordinator	(202) 382-2464
Sara Nicholas, Environmental Protection Specialist	(202) 475-8723

Region II

Sharon Atkinson, Remedial Project Manager	(212) 264-1217
Larry Granite, Remedial Project Manager	(212) 264-7668
Tamara Rossi, Remedial Project Manager	(212) 264-4593

Region III

John Banks, Remedial Project Manager	(215) 597-9562
Walter Graham,	(215) 597-2193
Kathryn Hodgkis, Deputy Branch Chief, Hazardous Waste Management Division	(215) 597-3480
Neil Swanson, Remedial Project Manager	(215) 597-7937
Paul Leonard, Remedial Project Manager	(215) 597-8257

Region IV

Al Cherry, Remedial Project Manager	(404) 347-7791
Martha Berry, Remedial Project Manager	(404) 347-2126
Beth Ann Eichenfer, Times Beach Public Relations Officer	(314) 938-6869
Bob Field, Times Beach Project Officer	(913) 236-2856
Robert Greene, Deputy Regional Counsel	(404) 347-2257
Al Hanke, North Carolina/South Carolina Unit, Waste Management Division	(404) 347-5065
Beverly Houston, Chief, Waste Management Division	(404) 347-2643
Doug Lair, Chief, Hazardous Waste Section, Environmental Services Division	(404) 546-3300
Jim Orban, South Florida Unit, Waste Management Division	(404) 347-2643
Bill Stiener, Cost Recovery, Waste Management Division	(404) 347-5059
Gina Townsend, Remedial Project Manager	(404) 347-5065
Eve Zimmerman, Remedial Project Manager	(404) 347-3633

Region V

Jeff Gore, Remedial Project Manager	(312) 886-6552
Diana Mally, Remedial Project Manager	(312) 353-6287
Pete Miller, Remedial Project Manager	(312) 886-6552
Gene Wong, Remedial Project Manager	(312) 886-6337

Region VI

Tim Underwood, Remedial Project Manager	(214) 655-6730

Region VIII

Barry Levine, Chief, Enforcement Section	(303) 293-1519

Region IX

Greg Baker, Chief, Federal Response Section	(415) 974-9252
Bill Lewis, Senior On-Scene Coordinator	(415) 974-7464

Region X

Cindy Colgate, Environmental Protection Assistant	(206) 442-1815
John Meyer, Remedial Project Manager	(206) 442-1271

Other Contacts

Carol Carmichael, Research Scientist, Hazardous Wastes Technical Assistance Program, Research Institute, Georgia Institute of Technology	(404) 894-7426
James Carr, Planning Director, Love Canal Area Revitalization Agency	(716) 283-9501
Joel Hirschhorn, Project Manager, OTA-ITE-362, Office of Technology Assessment	(202) 224-8996
Garrie Kingsbury, Senior Research Chemist, Center for Environmental Quality Assurance Research Triangle Institute	(919) 541-5861
James Kundell, Senior Public Service Associate Carl Vinson Institute of Government University of Georgia, Athens	(404) 542-2736
Ron Landy, Regional Expert Toxicologist, Region IV, U. S. Environmental Protection Agency	(404) 347-3866
Hugh Nourse, Professor, Legal Studies/Real Estate University of Georgia, Athens	(404) 542-3809
Margot Garcia, Chairperson, Environmental Planning Division, American Planning Association	(804) 367-1134
Helene Kassel, Environmental Planner, NUS Corporation	(703) 522-8802
Eric Schweitzer, Planner, NUS Corporation	(301) 258-8646
Ralph Wilmer, Environmental Planner, McGregor, Shea, and Doliner	(617) 227-7289
<u>California</u>: Mr. Stan Phillippe, Chief, Site Mitigation Unit California Department of Health Services	(916) 324-3773

Matthews Electroplating, Virginia:

Tim Beard, Associate Planner, Roanoke County Planning Department	(703) 772-2088
Dick Tabb, Sanitarian, Roanoke County Health Department	(703) 857-7807

Middletown Road Dump, Maryland:

Ronnie Larmore, Sanitarian, Maryland Health Department	(301) 631-3447

Mountain View Mobile Home Estates, Arizona:

Simon Navarro, Manager, Remedial Projects Unit, Arizona Department of Environmental Quality	(415) 257-2342

Quendall Terminal, Washington:

Nancy Laswell-Morris, Planner, Renton, Washington Long Range Planning Department	(206) 235-2552

Wade, Pennsylvania :

Don Becker, Chief, Pennsylvania Federal Superfund Site Section	(717) 783-7816
David Chakabarty, Health Officer, Chester, Pennsylvania, Health Department	(215) 447-7770
Lee Morrison, Director, Chester, Pennsylvania, Planning Department	(215) 447-7881

BIBLIOGRAPHY

Barbour, I. G. 1980. *Technology, Environment, and Human Values*. New York, NY: Praeger Publishers.

Barrows, R. L. 1982. *The Role of Federal, State and Local Governments in Land-Use Planning*. Washington, D C: National Planning Association.

Carmichael, C. S. 1988. *A Historical Case Study of the Federal and State Response to the Chemical Emergency at Love Canal in Niagara Falls, New York*. Masters Thesis, Georgia Institute of Technology.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Public Law 96-510, 94 Stat. 2767 December 11, 1980, codified at 42 U.S.C. Sections 9601-9657. *See* Superfund Amendments and Reauthorization Act of 1986 (SARA).

Finkbeiner, M. A. 1983. *Aerial Photographic Analysis of Waste Study Sites: Portland, Oregon, and Kellogg, Idaho*. Contract No. 68-03-3049. Las Vegas, Nevada: U.S. EPA Environmental Monitoring Systems Laboratory.

Georgia Department of Natural Resources, Environmental Protection Division. 1982. *Luminous Superfund Project Report: "Remedial Action for the Removal of Ra-226 contamination at the Luminous Processes, Inc. Site in Clarke County, Georgia."*

Gleason, P. J., et. al. 1989. Reducing Remediation Costs Through Development of Alternative Site Rehabilitation Levels. In *Proceedings of the 6th National Conference on Hazardous Wastes and Hazardous Materials of The Hazardous Materials Control Research Institute*, New Orleans, LA, April 12-14, 1989.

Kingsbury, G. L., and T. H. Bingham. 1988. *Reclamation and Redevelopment of Contaminated Land: Case Studies Europe*. Draft report prepared for U.S. EPA. Research Triangle Park, NC: Research Triangle Institute.

Kingsbury, G. L., and R. M. Ray. 1986. *Reclamation and Redevelopment of Contaminated Land: Volume I. U.S. Case Studies*. EPA/600/2-86/066. Cincinnati, OH: U.S. EPA Hazardous Waste Engineering Research Laboratory.

Kundell, J. E., et al. 1989. *Land-Use Policy and the Protection of Georgia's Environment*. Athens, Georgia: The University of Georgia Carl Vinson Institute of Government.

Lyons, J. J. 1986-87. "Deep Pockets and CERCLA: Should Superfund Liability Be Abolished?" *Stanford Environmental Law Journal* 6(27: 271-344.

New York State Department of Health. 1988. *Habitability Decision Report on Habitability: Love Canal Emergency Declaration Area.* Albany, NY: N.Y. Department of Health.

Nicholas, S. 1988. *Institutional Controls At Superfund Sites: A Study of Implementation and Enforcement Issues.* NNEPS Fellowship Report submitted to U.S. EPA Region II.

Nourse, H. O., and J. S. Trieschmann. 1988. *Managing the Risk of Liability from Environmental Contamination Costs.* Unpublished report of research supported by the Homer Hoyt Institute; Athens, GA.

Roberts, T. C. L. 1987. "Allocation of Liability Under CERCLA: A 'Carrot and Stick' Formula." *Ecology Law Quarterly* 14: 601-638.

Schoenbaum, T. J. 1985. *Environmental Policy Law: Cases, Readings, and Text.* Mineola, NY: The Foundation Press, Inc.

Sheridan, E. 1986-87. "How Clean Is Clean: Standards For Remedial Actions At Hazardous Waste Sites Under CERCLA." *Stanford Environmental Law Journal* 6(9): 9-42.

Smith, M. A. 1982. "2. The Development of Contaminated Land." *The Public Health Engineer* 10(4): 195-201.

Smith, M. A. 1982. "The 'Engineer' and Contaminated Land." *The Structural Engineer* 60A(1): 5-8.

Smith, S. M., and C. D. Zamuda. 1988. "The Role of Risk Assessment and Arars In Setting Protective Cleanup Standards at CERCLA Sites." In *Proceedings of the 9th National Conference of The Hazardous Materials Control Research Institute*; Washington, D C, November 28-30, 1988.

United Kingdom, Department of the Environment. 1987. *Development of Contaminated Land.* Circular 21/87. London: Her Majesty's Stationery Office.

United Kingdom, Department of the Environment. 1983. *Guidance on the Assessment and Redevelopment of Contaminated Land.* ICRCL 59/83. London: Central Directorate on Environmental Pollution.

U.S. Congress, Office of Technology Assessment. 1985. *Superfund Strategy.* OTA-ITE-252. Washington, D C: U.S. Government Printing Office.

U.S. Congress, Office of Technology Assessment. 1988. *Are We Cleaning Up? 10 Superfund Case Studies - Special Report.* OTA-ITE-362. Washington, D C: U.S. Government Printing Office.

U.S. Congress, Office of Technology Assessment. 1989. *Coming Clean: Superfund Problems Can Be Solved.* OTA-ITE-433. Washington, D C: U.S. Government Printing Office.

U.S. Environmental Protection Agency. 1983. *Remedial Action Master Plan: Bunker Hill, Kellogg, Idaho.*

U.S. Environmental Protection Agency. 1986. *Record of Decision: Toftdahl Drums, Clark County, Washington.*

U.S. Environmental Protection Agency. 1988a. *National Oil and Hazardous Substances Pollution Contingency Plan.* 40 CFR 300; Office of the Federal Register National Archives and Records Administrator.

U.S. Environmental Protection Agency. 1988b. *Record of Decision for Final Management of Dioxin-contaminated Soil and Final Disposition of Structures and Debris at Times Beach, Missouri and the Minker/Stout/Romaine Creek Site, Missouri.*

U.S. Environmental Protection Agency. 1988c. *Responsiveness Summary; Record of Decision for Final Management of Dioxin-contaminated Soil and Final Disposition of Structures and Debris at Times Beach, Missouri and the Minker/Stout/Romaine Creek Site, Missouri.*

U.S. Environmental Protection Agency. 1988d. *Superfund Record of Decision: Love Canal, N Y.*